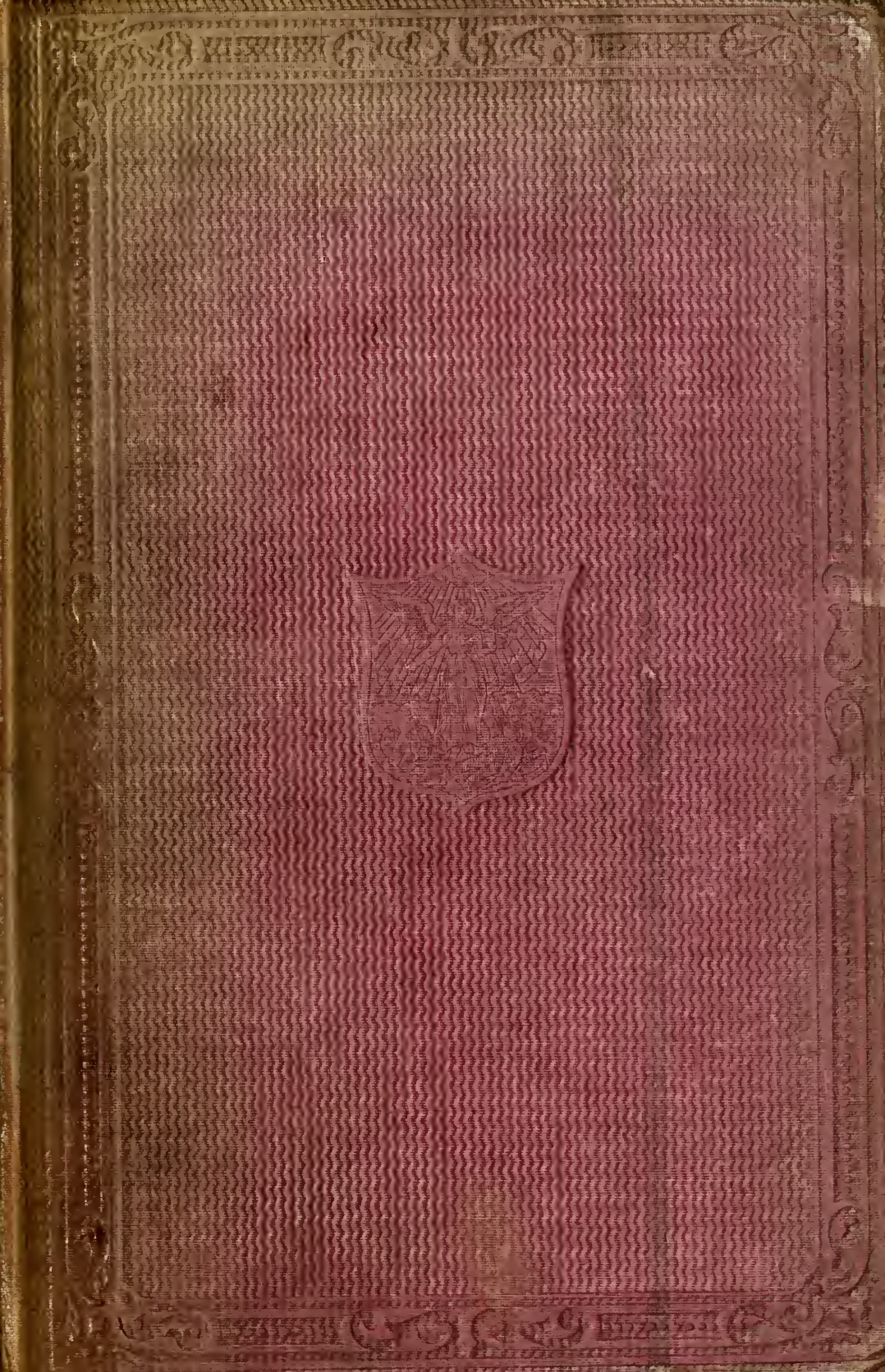

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MILITARY

MEDICAL AND SURGICAL ESSAYS

PREPARED FOR THE

United States Sanitary Commission.

EDITED BY

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PREFACE.

The essays which are contained in the present volume were prepared, under the auspices of the United States Sanitary Commission, by gentlemen selected for their presumed acquaintance with the subjects upon which they were desired to write, and were originally published as separate monographs for gratuitous distribution to the medical officers of the army. The favor with which they have been received both at home and abroad, and the wish expressed in many quarters that they might be arranged in a more permanent form, have led to their collection and republication in one volume.

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When the rebellion broke out, there were but few works treating of medical subjects from a military point of view which were attainable by the thousands of physicians who entered the army. That much good has been accomplished by the essays contained in this volume, scarcely admits of a doubt. The demand for them has been immense, and all of them have been reprinted several times. Though at the present day, when through the large experience which our army medical officers have acquired, such monographs are scarcely necessary for their use, there are continually new candidates for military service coming forward to whom they cannot be too highly recommended. For they are simple, prac-

tical memoirs, written without any attempt at a display of learning, but in such a style as was thought best adapted to the end in view. Moreover, it is believed that many will be glad to have them in a collected form, if not from any use they may hereafter be, at least as interesting memorials of one object which the Commission had at heart from its organization to the present moment.

In arranging these essays, I have disregarded the order of their publication, and have placed them in three groups, according to the subjects upon which they treated. Thus, those which relate to the prevention of disease come first; those on medical subjects next; and those relating to surgical matters last. It is believed that this plan has advantages over the unsystematic arrangement which would have resulted from following the order of publication.

To several of the memoirs I have added a few short notes, either in explanation or for the purpose of conveying information not available at the time the essays were written. Had more time been allowed, I might have been tempted to extend my labors in this direction.

It is probable that a second series of such monographs will be published, as there are several subjects of importance now in hand, and yet to be considered.

It may appear superfluous for me at this time to express an opinion of the inestimable service the United States Sanitary Commission has rendered to the sick and wounded soldiers of the army. Without official power, oftentimes with prejudices to overcome, without the hope or expectation of reward, save in the approval of their own consciences, and the appreciation of their acts by

their fellow-citizens, the members have given their time and their labor to their country, not only in devising means of relief, but in personally visiting the hospitals and battle-fields, and rendering their aid to the medical officers charged with the immediate care of the sick and wounded.

It is impossible for any government to do all needful acts for the disabled after a severe battle. Even under the most favorable circumstances, when there are no false views of economy prevailing, and when supplies are in profusion, there is so often a want of co-ordination in the several departments, so many military circumstances to be considered, so much to be done, and so few to do it, that an amount of suffering exists which no government can obviate. At such times a body of men representing the loyal and charitable people of the country, with ample means, fettered by no military restraints, and combining in themselves, to a certain extent, the functions of the medical, the quartermaster's, and the subsistence departments, acts with a degree of promptness and thoroughness which can never be attained under the ordinary military organization. The first duty of the military commander is undoubtedly to gain the victory. Ordnance supplies and food for his men and animals are indispensable. Hospital stores, when there is not room for all, must be left behind for a more convenient season. The Sanitary Commission has but one grand object—the prevention and relief of human suffering. Its wagons and other means of transportation are used for this purpose alone, and hence they are enabled to push forward their supplies frequently days in advance of those belonging to the government. A medical department, with inde-

pendent means of transportation, could do much to lessen the labors of such a Commission, but it could not entirely supersede them; for in the one case a responsibility and subjection exist which do not influence the actions of those who are charged directly by the people with a specific duty, and who have at their command all the means with which to perform it.

To the good relations which have existed, with scarcely an exception, between medical officers and the Sanitary Commission and its agents, a great deal of the success which has been obtained must be ascribed. With no idea of supplanting the regular medical authorities, with no disposition to excite jealousy or other unworthy feeling, the Commission has pursued its course as the friends and supporters of those in whose labors they have desired to assist. Not only to their own devotion to duty are the medical officers of the army to attribute the high degree of confidence the country reposes in them, but in no small measure to the persistent and untiring efforts which the Commission has made in calling attention to ability, to integrity, to faithfulness, which otherwise might have been lost sight of in the mass of other circumstances which the world is more disposed to look upon with admiration.

WILLIAM A. HAMMOND.

Washington City, *July 4th*, 1864.

CONTENTS.

PAGE

I. Military Hygiene and Therapeutics.—By Alfred Post, M.D., and William H. Van Buren, M.D..... 11

II. Control and Prevention of Infectious Diseases.—By Elisha Harris, M.D..... 45

III. Quinine as a Prophylactic against Malarious Diseases.—By William H. Van Buren, M.D..... 93

IV. Vaccination in Armies.—By F. G. Smith, M.D., and Alfred Stillé, M.D..... 119

V. Rules for Preserving the Health of the Soldier.—By William H. Van Buren, M.D..... 159

VI. Scurvy.—By William A. Hammond, M.D..... 175

VII. Miasmatic Fevers.—By John T. Metcalf, M.D..... 207

VIII. Continued Fevers.—By J Baxter Upham, M.D..... 237

IX. Yellow Fever.—By John T. Metcalf, M.D..... 267

X. Pneumonia.—By Austin Flint, M.D..... 297

XI. Dysentery.—By Alfred Stillé, M.D..... 329

XII. Pain and Anæsthetics.—By Valentine Mott, M.D..... 385

PAGE

XIII. Hemorrhage from Wounds, and the best means of arresting it.—By Valentine Mott, M.D..... 403

XIV. Treatment of Fractures in Military Surgery.—By John H. Packard, M.D..... 431

XV. Amputations.—By Stephen Smith, M.D..... 459

XVI. The Excision of Joints for Traumatic Cause.—By R. M. Hodges, M.D..... 501

XVII. Venereal Diseases.—By Freeman J. Bumstead, M.D..... 531

MILITARY HYGIENE

AND

THERAPEUTICS.

MILITARY HYGIENE

AND

THERAPEUTICS.*

Your committee begs leave respectfully to report that it has directed its attention chiefly to matters of practical interest which are not discussed in the ordinary books on surgery. The duties of a military surgeon involve a high degree of responsibility, and upon their skillful and faithful performance, the efficiency and success of armies is largely dependent. The ancient poet took a correct but altogether too limited view of the usefulness of military surgeons, when he uttered the sentiment—

> "A wise physician, skilled our wounds to heal,
> Is more than armies to the public weal."

The principal duties of the medical staff of the army are comprehended in the two classes of military hygiene and military therapeutics. The former of

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* This paper was prepared for the New York Academy of Medicine, but subsequently published by the Sanitary Commission.—W. A. H.

these two classes, although it attracts much less popular attention than the latter, is by no means inferior to it in practical importance. The statistics of armies clearly reveal the fact, that a much larger number of soldiers die from disease, resulting from unfavorable hygienic circumstances, than from wounds inflicted in battle. Even the dreadful slaughter of Waterloo and Solferino has been exceeded in its desolating power by the pestilential diseases by which large armies have sometimes been invaded. A few examples will suffice to show the extent to which armies have been scourged by disease. Sir David Stewart mentions "that the 92d Regiment lost more officers and men in four months from the climate of Jamaica, than by the hand of the enemy in an active war of 22 years, in the progress of which it was 26 times in battle." Sir James McGrigor, in his account of the diseases of the Peninsular army in 1812, 1813, and a part of 1814, says "that there were 68,894 cases of fever, of which 6703 died, equal to 9·7 per cent.; and 7526 cases of dysentery, of which 4717 died, equal to 62·5 per cent." Sir John Pringle says "that of the troops stationed, during 1847, in South Beviland and the Island of Walcheren, some of the corps were so sickly as not to have more than 100 men fit for duty, which was less than the seventh part of a complete battalion." In a paper by Mr. Edmonds, compiled from returns in the Adjutant-General's Office, it is stated that "in the Peninsular army, averaging a

strength of 64,227, including officers and men, the annual ratio of mortality, from the 25th of December, 1810, to 25th of May, 1813, was 10 per cent. of the officers, and 16 per cent. of the men, and that this army had during the above period 22½ per cent. constantly sick." In the report of the British Sanitary Commission dispatched to the seat of war in the East, in 1856, it is stated that, "on the week ending April 7th, the sick and wounded amounted to 124 in every thousand, or nearly an eighth part of the army. The wounded were only 5 per cent. of this proportion. The force amounted to 31,610 men." After the attack on the Redan, the wounds amounted to 40 per cent. of the admissions, the remaining 60 per cent. being sick. During ten weeks, the admissions from wounds amounted to 3858, or 10 per cent. of the force; and the deaths from wounds to 334=0·37 per cent. of the force. During the same period, the admissions for disease amounted to 18,683=48·7 per cent. of the force, and deaths from disease to 1309=3·04 per cent. of the force, or at the rate of 17·6 per cent. per annum. Only 17 per cent. of the total admissions, and 20 per cent. of the total deaths, were due to wounds exclusive of deaths on the field. Bazancourt, in his account of the Expedition to the Crimea, speaking of the operations in the Dobrudscha, says that "General Yusuf had resolved by a night march to fall suddenly upon the body of troops assembled around Babadagh, but at the moment when (at about 6 o'clock in the

evening) the order for departure was given, 500 men lay stretched upon the earth unable to rise: the cholera had fallen like a thunder-bolt upon the expeditionary column. At 8 o'clock, there were already 150 dead, and 350 dying." The pestilence continued its ravages, and the expedition to the Dobrudscha was consequently given up.

The whole number of officers and men sent to the East by the French government, during the period of two years, was 309,268. Of this number 200,000 were under treatment at the ambulances and hospitals, viz., 50,000 for wounds, and 150,000 for diseases. The medical officers of the French army arranged their plans for taking care of their sick and wounded on the basis of the calculation that 10 per cent. would be under treatment at one time. So, at the period when the number of their troops was limited to 40,000, they made provision for 4000 to 5000 patients. In the attacks of cholera during the Dobrudscha expedition the proportion of deaths to attacks was as 1 to $1\frac{3}{10}$. More than 8000 French soldiers were placed *hors du combat* by the cholera in the epidemic of Varna and Dobrudscha. At the end of February of the first winter in the Crimea, there were 3000 cases of scurvy in the French army, averaging 100 for each old regiment, and 25 for each new one. At the same period the wounds presented an unhealthy appearance, the granulations were flabby, traumatic gangrene was frequently observed. In the

month of June, 1855, there were 4000 cases of cholera, and more than 6000 wounds. The medical officers suffered greatly in health from their incessant and exhausting labors, about one-third of their number being sick. After the battle of Traktir Bridge, in August, 1855, the French surgeons performed 300 amputations and resections. A number of them were obliged to walk a great distance to the field of action; they were occupied with dressing wounds nearly the whole day, exposed to the heat of the sun, and then returned in the afternoon to the stationary ambulances, to perform urgent operations, which were not completed before midnight. The Malakoff was taken in September, 1855, after 316 days of hard work and fighting in the trenches. A million of sand-bags and 80,000 gabions had been employed. There had been 600,000 discharges of cannon and mortars. Twenty leagues of trenches had been opened. After the taking of the Malakoff, the French surgeons had the care of 5000 wounded persons, including many of the Russians. The whole number of patients under treatment at that time in the French ambulances was 10,520. In one division, three surgeons and one apothecary had the entire care of 900 patients. The number of the wounded after the battle of the Tchernaia was 2474, viz., 810 French and 1664 Russians, coming under the care of the French surgeons. Typhus fever broke out in the French army in December, 1855; in that month there were 734 cases. In

January there were 1523 cases. During the two months, 787 cases terminated fatally. In February there were 3402 cases, of which 1435 were fatal. The disease attacked large numbers of persons who had been previously sick with other diseases. Every other disease seemed to be transformed into this terrible scourge. Seventy-five French surgeons in the Crimea were sick with typhus, and thirty-one died of it. Scrive says that "the losses occasioned by the most murderous battles do not equal one-fourth of the total losses to which an army is ordinarily subjected." Scrive, in reporting the sanitary condition of the army in February, 1856, makes the following remarks:—

"The regiments were not all attacked in the same degree. The proportion of the sick bears a close relation to the energy of the exciting causes. Thus, but few patients were found in the 17th battalion of chasseurs—10 out of 450 men. This battalion is comfortably quartered in barracks of good elevation; the ground is carefully paved; each soldier has a bed raised thirty centimetres, or about twelve inches, from the ground. Perfect cleanliness is observed throughout. The sea of mud of the adjoining streets is replaced by a stone pavement. Great care is taken as to diet, and vegetables are never wanting. The chasseurs are a chosen body of robust and intelligent men, and the site of their encampment is a very healthy one. The 85th Regiment is the worst treated of all; it counts about 200 patients, waiting until places can be found for them in the hospitals. This regiment is badly sheltered, and presents all the causes of disease in an exaggerated state. Among the other regiments, the 57th has nearly 200 sick, the 10th has 150, the 61st 200, the 6th dragoons 40, 7th dragoons 30, 4th hussars 50, infantry of marine

20, engineers 13, artillery 100. In all these regiments there is not a single case of sickness among the officers, who are better lodged and fed."

The whole number of French troops sent to the army of the East, as already mentioned, was 309,268: the whole number of deaths was 69,229; of this number there were 7500 who were killed on the battle-field, or not afterward heard from. The total attacks of cholera in the French army of the East amounted to 18,400. Of this number 11,000 were fatal. Attacks 1 to 15 of the army; deaths 1 to $1\frac{6}{10}$ of the cases. The total attacks of typhus were about 35,000; total deaths from the same disease 17,515. The whole number of cases of diarrhœa was 19,339, of dysentery 6105. Scurvy prevailed to a great extent during the severe cold of winter, and during the sultry heat of summer, but almost disappeared during the spring and autumn. Scrive says that "the single efficient cause of scurvy was the absence of fresh vegetables." He adds, "scurvy, like typhus, can be created at will." A considerable number of French soldiers died from exposure to cold, frosted limbs, etc. Most of these were intemperate persons. Among the wounded in battle, 1 in 5 died on the field, the proportion being the same in the three battles of Alma, Inkerman, and Traktir Bridge. The proportion of amputations was about 1 out of 6 wounded. During the first five or six weeks of the siege the health of the troops was good, and the

wounds pursued a favorable course; at a later period the wounds did not do so well.

From the facts which have been presented, it is very evident that the lives of military men are much more endangered by disease than by wounds received in battle. It is, then, one of the highest duties of an army surgeon to make himself well acquainted with the correct principles of military hygiene, and to exert his influence to the greatest possible extent in promoting the health and physical energy of the soldiers who are intrusted to his care. Your committee proposes to consider the subject of military hygiene in some of its most important details.

I. The Selection of a Ground for an Encampment.

It is a matter of the utmost importance, whenever it is practicable, to avoid encamping in a malarious district. The encamping ground should be dry, moderately elevated, and with a sufficient slope to prevent water from stagnating when it rains. It should be in the vicinity of pure water, drinking and washing, and there should be an abundant supply of fuel for cooking. The want of water in the vicinity of an encampment is a very formidable evil. When the French army, after the battle of Alma, encamped near the village of Mackenzie, they found but two or three wells, which were soon exhausted. The sol-

diers called the camp "the camp of thirst." They endured great suffering in consequence of the want of water. In selecting a site for encampment on the banks of a river, care should be taken to guard against the danger of inundation by a rapid rise of the water from melting of snow, or from a sudden fall of rain. If military necessity should require an encampment in the neighborhood of an extensive marsh, the ground should always, if possible, be selected on the windward side, so that the prevailing winds should carry away the noxious emanations from the soil. When soldiers are exposed to cold and damp air without suitable protection, the injurious effects of such exposure will be diminished by the judicious use of camp-fires. In malarious districts, the protective use of the sulphate of quinine is to be highly commended. Each man may take three to ten grains daily, according to the intensity of the malarious influence. It may be taken in one dose at bedtime.

II. The Construction and Arrangement of Tents, and other means which are employed to protect the Soldiers from the Weather.

Tents should be made of a strong material and of close texture, so as to perfectly exclude the rain. The ground on which the soldier lies should be covered with boards, with straw, with twigs of pine, hemlock, or cedar, or with India-rubber cloth, to ex-

clude the moisture from beneath. In hot weather, where there are no shade-trees, the tents should be double, to exclude the solar heat, and ventilation should be afforded on the shady side. There should also be openings for ventilation at the upper part of the tents, to carry off the heated gases which accumulate in those regions. A sufficient number of tents should be provided to prevent overcrowding; and if, in any emergency, it should be necessary to crowd an unusual number of persons in a tent, the evil should be counterbalanced, as far as circumstances will permit, by increased ventilation. The tents should not be allowed to remain many days in the same position, as the ground which they cover absorbs the emanations from the body, and thus vitiates the air. In fine weather the tents should frequently be taken down in the morning and put up again in the afternoon or evening. Every fine day the clothing and bedding should be freely exposed to the outer air. A sufficient space should be allowed between the tents to admit free ventilation. When the tents have been removed to a new ground, unless it be to a great distance from their former site, the ground from which they have been removed should be purified by sprinkling it freely with charcoal, lime, or other disinfecting agents. When circumstances forbid the removal of the tents, the ground may be purified by a similar use of antiseptic agents. The French army surgeons in the Crimea used sulphate of iron as a disinfecting

agent. It was dissolved in fifteen times its weight of water. Three litres were used to disinfect a square metre of ground. It was also poured on collections of filth, feces, etc. A litre is a little more than a quart; a metre is about thirty-nine inches.*

When soldiers are making forced marches, and means of rapid transportation are insufficient, as they usually are on such occasions, it is better to dispense with the use of tents, and to sleep in the open air, as a more abundant supply of food, clothing, blankets, and other articles which are more indispensable to the health and comfort of the troops, may thus be transported. When an army is to be encamped during the winter, wooden huts are to be preferred to tents, as affording better protection to their inmates. In the construction of these huts, it is very important to make ample provision for efficient ventilation, and to avoid overcrowding. There should be openings for ventilation at the ends, sides, and ridge of each hut. They should also have projecting eaves—boards to protect the sides from the heat of the sun, and to prevent the entrance of rain or snow through the openings which are left for ventilation. They should be whitewashed with lime within and without. Care should be taken to prevent accumulations of water

* A weak solution of permanganate of potash sprinkled over the ground to be disinfected, or over any filth it is deemed necessary to deodorize, is perhaps the best agent to employ.—W. A. H.

about tents or huts. The ground should be sloping, and, whenever it is necessary, trenches should be dug to carry off the water. When an encampment is to remain long in one place, and the ground is tenacious of moisture, the streets between the tents or huts should be paved.

III. The Disposition of Excrements and Offal.

Pits should be dug on the leeward side of the camp, and ordinarily at a distance of not less than two hundred yards. They should be at least four feet in depth, and the bottom should be covered with charcoal. Such offal as cannot be consumed by fire should be thrown into the pits each day, and then covered with charcoal and a few inches of earth. When the matter reaches within two feet of the surface, cover with charcoal, and fill up with earth a little above the level of the adjacent surface. No pit should be dug for such purposes near any source from which water is supplied to the camp. Dead animals and offensive offal should be buried immediately, at such a depth that at least three feet should intervene between their upper surface and the level of the ground. Before the pit is filled in, the carcass or offal should be covered with charcoal. Similar precautions should be observed in the interment of human bodies. After a severe engagement, attended with great loss of life, the bodies should be interred in trenches eight or ten

feet in depth. When offensive emanations arise from the ground, in consequence of the decomposition of organized substances, the surface should be covered with deodorizing materials. The British sanitary inspectors in the Crimea recommended for this purpose a compound consisting of one part of peat charcoal, one part of quicklime, and four parts of sand or gravel. M. Scrive, medical inspector of the French army in the Crimea, recommended a solution of chloride of lime for the same purpose. He sometimes advised the use of solution of sulphate of iron to accomplish this object. He also directed the bodies of men and animals to be covered with a thick stratum of lime, after being buried at a proper depth.

IV. Clothing.

Flannel should be worn next to the skin. The clothing should be light, and should be so adjusted as not to interfere with the most perfect freedom of muscular action. Each soldier should be provided with one or more blankets, for protection during the night. The clothing should be washed and thoroughly dried as often as circumstances will permit. From the first of October to the end of May, each soldier should be provided with a thick overcoat to protect him from cold and stormy weather. The feet should be covered with stockings, and stout shoes with broad soles and low heels. The shoes should

not be tight so as to pinch the feet, but they should not be excessively loose. Great care is required with fresh recruits, to prevent the feet from becoming sore. If the heel becomes slightly chafed, the part should be at once covered with adhesive plaster. For want of this simple precaution many soldiers have become disabled, and have thus fallen into the hands of the enemy, and, in contests with savages, have lost their lives. In hot weather, the heads of the soldiers should be protected by means of straw hats or havelocks.*

V. Supply and Preparation of Food and Drinks.

This is a subject of great importance to the health and efficiency of armies, and the neglect of which is apt to be followed by the most disastrous consequences. It is highly important not only that the supply of food should be ample, but that its quality should be good, and that it should be in such a form that it can be prepared for use as speedily and with as little labor as possible. Hard biscuit or pilot-bread may be furnished alternately with soft bread; and care should be taken to prevent the use of any bread of inferior quality. Butter and cheese may be added with the morning and evening meal, on which occasion coffee or tea should also be provided. The coffee

* India-rubber coats, by retaining the cutaneous exhalations in contact with the body, do more harm than good. Their use should be discouraged.—W. A. H.

which is furnished to the men should be already roasted and ground, so that it can be prepared with little labor. There should always be a sufficient allowance of sugar and milk. Where fresh milk cannot be obtained in sufficient quantities, solidified milk may be used as a substitute. There should be a regular allowance of meat and vegetables at dinner, whenever it is practicable to furnish them. Soldiers should not be confined for a long time to salted meat; but fresh meat should always be allowed whenever it can be obtained. The use of fresh vegetables is of very great importance as a means of guarding against scurvy. There are many herbs or weeds growing in the fields or by the roadsides, which can be employed for this purpose when better vegetables cannot be obtained. Thus, the French soldiers in the Crimea derived the greatest advantages from the use of dandelion, (Leontodon Taraxacum,) dressed with oil and vinegar, and eaten as a salad. Fruits should also be provided in their season, either in a fresh or dried state. When fresh vegetables cannot be obtained, their place may be in part supplied by the use of vegetables desiccated in a rarefied atmosphere. There seems to be no good reason why soldiers should not be fed as well, under ordinary circumstances, as the better class of laboring men at home. It would be very desirable that there should be at least one good cook for every company of soldiers, as the wholesomeness of their food depends very much on the manner

in which it is prepared. General Scott is reported to have said, that a man who cannot make good bread is not fit to be captain of a company. An ample supply of good water, for drinking and cooking, is a matter of great importance to the health and comfort of soldiers. It would be well if every regiment were supplied with a distilling apparatus, by means of which the water of marshes or even of the ocean could be purified. Distilled water, agitated so as to mix with it a sufficient quantity of air, might often be substituted with great advantage for the impure and unwholesome water which soldiers are compelled to drink. Great care should be taken to guard against the excessive use of alcoholic drinks. It would be well for the young men in our armies to make no use of these beverages, except when they are prescribed for medicinal purposes.

There can be no reasonable doubt that the health of armies has been in many instances greatly impaired, and that multitudes of valuable lives have been lost, in consequence of the insufficient quantity or the bad quality of the food which has been furnished. The errors which have been committed in this respect have sometimes been due to mistakes at headquarters, sometimes to a want of knowledge or of attention on the part of the commissaries of regiments, and sometimes to the knavery of contractors, who have committed wholesale murder by depriving the soldiers of the full supply of good food which they

have engaged to furnish, and for which they have received ample compensation. It is not improbable that the Austrian army was defeated at Solferino in consequence of the soldiers being exhausted by long fasting, the Commissary-General having appropriated to his own use the funds which were furnished him for the purpose of providing rations for the army. It is important that the rations of the soldiers should, under ordinary circumstances, be issued daily. When rations are distributed at one time for several days, there is often at first an unnecessary waste, in consequence of which the soldiers afterward suffer from want, or supply themselves by plunder. With regard to the hard biscuit usually furnished to the soldiers as a part of their diet, M. Scrive says that it should be made thinner and more friable, as by its thickness and hardness it irritates and inflames the gums. M. Scrive also says that, when fresh meat cannot be supplied to the army, it should be replaced by preserved meats and soups; and that salt beef should, as far as possible, be abandoned as an article of food for soldiers, especially in long campaigns and in distant regions, as it is very apt to become spoiled. Borden's meat-biscuit may be a valuable article of diet, when fresh meat cannot be obtained. When soldiers have long been confined to the use of salted and smoked provisions, and fresh meat is afterward liberally supplied to them, they are very apt to be attacked with severe and often fatal dysentery. The precaution

should therefore be adopted to furnish to the men at first a very limited supply of fresh meat; the quantity may be gradually increased, as they become accustomed to its use. The dysentery, occurring under these circumstances, is stated by Dr. Hewitt, formerly surgeon in the U. S. army, to be most readily cured by purging with sulphate of magnesia.

VI. Means of preserving the Health of Soldiers.

As a means of preserving the health of soldiers, great care should be taken, as far as military necessities will allow, to avoid excessive and exhausting labor, and to allow ample time for sleep. There is no doubt that a large part of the mortality among the troops who were engaged in the Crimean war was owing to the perhaps unavoidable violation of these rules. The men were engaged in almost incessant labor, and their sleep was often disturbed, while, at the same time, they were exposed to the heat and cold, rain and snow, with very insufficient protection. Whenever it is necessary to have a large amount of labor performed, it is better, if practicable, to hire laborers, than to require an excessive amount of work from the soldiers.

Under the head of military therapeutics, are to be considered the preparations which are required for the practice of medicine and surgery under the peculiar circumstances attending the movements of armies,

and the actual treatment of diseases and injuries occurring under those circumstances. In laborious marches, in obstinate and protracted sieges, in sudden and unexpected assaults, in severe and bloody engagements, the military surgeon is called in rapid succession to the treatment of large numbers of sick and wounded soldiers. There is no time for calm deliberation and careful preparation; he cannot send his prescriptions to an apothecary, nor can he send to a manufacturer for new instruments or apparatus. The few medicines, instruments, and dressings which he requires must be at hand, or his patients must be deprived of the benefits which they would have derived from them. A wise foresight must therefore be exercised in providing such materials as are indispensable to the care of the sick and wounded, and in conveying them to every place where they may be needed. All bulky and heavy articles which are not absolutely essential should be dispensed with, on account of the difficulty and delay in conveying them from place to place. The best way of conveying the apparatus of an army surgeon is a box-cart, similar to those which are often used by peddlers. In going over a country too rough for wheel-carriages, a pair of panniers slung over the back of a horse or mule is the best substitute for a cart. The weight of the panniers with their contents should not exceed two hundred pounds.

Each surgeon should be provided with a case of

amputating and trephining instruments, with scalpels, bistouries, lancets, and other instruments for minor operations. He should always have about his person a good case of pocket instruments, and a canteen containing wine or brandy and water, ready to be used as a cordial in any case of emergency. He should also carry in his pocket a phial containing pills of opium. In the cart or panniers containing his apparatus there should be a supply of sponges, bandages, lint, tow, cotton batting, old linen or muslin for compresses, ligatures, tin basins, splints, adhesive plaster, pins, needles, matches, candles, catheters and bougies, a stomach-pump, an enema-pump, and a suppository syringe. There should be a dozen tourniquets, and the orderlies, who act as assistants to the surgeon, should be instructed in their application. There should also be a supply of anæsthetics and of medicines suitable to the emergencies of military life. On the field of battle, each surgeon should be immediately followed by an orderly, bearing a knapsack containing a few of the most indispensable instruments and dressings for immediate use. Previously to an engagement, a certain number of men from each company should be deputed to take charge of such soldiers as may be wounded, and to remove them at once to a place of safety in the rear of the army. For this purpose, litters should be at hand, made of stout canvas, with stretchers, and provided with rings, into which bayonets or poles may be inserted. Am-

bulance carts should also be brought as near as possible to the scene of the engagement, and the wounded soldiers should be speedily deposited in them, and driven off to the place selected, where they may receive proper surgical attention.*

The U. S. Army Medical Board recommend that the following schedule of transports for the sick and wounded, and for hospital supplies, be adopted for a state of war with a civilized enemy:—

"For commands of less than three companies, one two-wheeled transport cart for hospital supplies; and to each company, one two-wheeled ambulance.

"For commands of more than three and less than five companies, two two-wheeled transport carts; and to each company, one two-wheeled ambulance.

"For a battalion of five companies, one four-wheeled ambulance, five two-wheeled ambulances, and two two-wheeled transport carts. For each additional company, less than ten, one two-wheeled transport cart.

"For a regiment of ten companies, two four-wheeled ambulances, ten two-wheeled ambulances, and four two-wheeled transport carts; and for greater commands in proportion."

Also that "horse-litters may be prepared and furnished to posts, whence they may be required for service on ground not admitting the employment of two-wheeled carriages; said litters to be composed of a canvas bed similar to the present stretcher,

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* The recent enactment by Congress of a law providing for the establishment of an ambulance corps, to be under the control of the Medical Director, does away with the necessity of detailing men for this duty.—W. A. H.

and of two poles, each sixteen feet long, to be made in sections with head and foot pieces, constructed to act as stretchers to keep the poles apart."

Also, that "the allowance of hospital attendants in the field will be, for one company, one steward, one nurse, and one cook; for each additional company, one nurse; and for commands of over five companies, one additional cook."

The Army Board also recommend hospital tents of the following dimensions: "In length, 14 feet; in width, 15 feet; in height (center) 11 feet, with a wall 4½ feet, and a fly of appropriate size. The ridge pole to be made in two sections, and to measure 14 feet when joined." The Board contemplate that such a tent will accommodate 8 to 10 patients comfortably. It is evident, however, that the space allowed for each patient is altogether too small, amounting to only a little more than 160 cubic feet for each patient.

In making arrangements for the care of sick and wounded soldiers, there should be hospital tents erected as near as possible to the field of battle, so that dressings and operations which are urgently required may be performed without any unnecessary delay. There should also be regimental hospitals, which may be constructed of tents, huts, or more permanent buildings, according to the season of the year and the character of the military operations. Each regimental hospital should have accommodations for 50 to 100 patients. There should also be

general hospitals at the base of operations, and in these there should be ample accommodations for all the patients which may be sent to them from the regimental hospitals, or directly from the camps or the battle-field. The regimental and general hospitals should contain sufficient space to allow not less than 800 cubic feet of air for each patient. The horizontal space should not be less than 6 by 6 feet for each patient. Large public buildings, such as churches, concert-rooms, and public halls, are commonly employed as general military hospitals. It is often necessary to make extensive alterations to adapt them to their new use. Special regard should be paid to ventilation. The doors and windows usually require to be enlarged, especially in an upward and downward direction; or numerous holes, six inches square, may be made through the walls near the floors and ceilings. There should be doors and windows opposite to each other, so as to allow the air to pass freely through in all directions. The patients should not be placed in stories below the level of the ground or but slightly raised above it, as experience has shown that the upper stories are much more salubrious. The beds should be raised from the floor, being placed on iron bedsteads whenever they can be obtained. No two bedsteads should be in contact, and none should touch the walls of the room. No unnecessary articles should be in the wards, as they occupy valuable space, and absorb noxious vapors. Care should be

taken that the windows do not open upon any receptacles of foul air. Besides the principal hospital buildings, there should be small detached houses reserved for special cases. Near the entrance of the town some building or tents should be selected as receiving hospital, where the wounded should be brought and properly cleansed, wounds dressed, and suitable hospital clothes provided; and then they should be forwarded to the permanent hospital. Great attention should be paid to privies and drains connected with the hospital, to prevent them from contaminating the atmosphere. Patients who are able to rise from their beds should eat in adjoining rooms or tents. The wards of the hospitals should be divided into three classes, viz., surgical, medical, and convalescent. To every division of one hundred beds, there should be at least one ward superintendent and six orderlies. When the hospital is prepared, the compound fractures should be placed in the most accessible wards, and injuries of the same character should be placed in the same wards. When wine or spirits are directed, the surgeon should see them administered. To preserve the purity of the air, the wards should be frequently whitewashed with lime. The adjacent grounds should be well drained, and the sewers should be frequently flushed. Excretions should be as soon as possible removed from the wards. The temporary hospitals attached to camps are subject to terrible mishaps. Bazancourt speaks in the

following terms of the effects of a hurricane upon the frail structure used as a military hospital by the French army in the Crimea:—

"The ambulance barracks are shattered by the fury of the wind; and while their roofs, carried up in the air, whirl around and disappear, the broken timbers fall upon the wounded and the sick, whose beds are overturned into the pools of rain which inundate them. Most of the patients are unable to move, being quite prostrated by illness, or by severe wounds, and lie waiting with resignation that which the will of God may determine respecting them."

In the French army in the Crimea each ambulance* for 10,000 men had 3 caissons, containing materials for 6000 dressings, and 18 complete tents. Flying ambulances on mules' backs were provided for regions where carriages could not go. As an example of the manner of taking care of the wounded during and after an engagement, your committee presents the following directions given by M. Scrive to the medical officers of the French army in June, 1855:—

"At the ambulance of the trenches shall be assembled before the battle the non-combatant soldiers—the musicians of the regiment, for example, with the infirmary men disposable in the different services. One or several officers of administration will direct them in the trenches to take up the wounded, and transport them to the ambulance. An officer of administration, having

* The signification which the French give to the word ambulance is different from that which we attach to it. With them it means a field hospital, with us a vehicle for transporting the sick and wounded.—W. A. H.

a fixed position at the ambulanee, will attend to plaeing the wounded, on their arrival, in an order always the same, and determined beforehand, to avoid eonfusion. The visits to the wounded shall be made by one or more surgeons, assisted by two or more infirmary men earrying dressings, ete.; one of these last will inscribe the name of the patient, his regiment, and his matriculated number. The surgeon will determine whether the wound requires to be dressed immediately, or if the patient ean be at onee transported to the ambulanee of the division. In the first plaee, the wound may be dressed on the spot, or, if an immediate operation is required, the patient may be eonveyed into the operating room. After the dressing or operation, the patient may be plaeed upon the litter or ambulance eart. Where four to six wounded persons are ready, they shall be eonveyed together to the ambulance of the division; and in these little sueeessive journeys, the muleteers, under the direetion of an offieer commanding the train, shall betake themselves to the ambulanee, whose number shall have been designated by the military subintendant or his aid, who shall mark upon the list of vacant places, at the different stationary ambulanees, the names of the wounded whom he will send there sueeessively. In this manner the exaet situation of the ambulances will be preeisely known. When the wounded are very numerous, no operations shall be performed exeepting those which are absolutely neeessary. One-third of the surgeons shall be constantly occupied in visiting the wounded, and judging as to the neeessity of immediate operation or dressing, espeeially when the number of the wounded is large; the remaining two-thirds shall attend to the neeessary operations and dressings, following, except in cases of great urgeney, the order of arrival and the rank of the patient. In the ambulanee of the trenehes, the serviees of the infirmary men may be eonveniently divided in the following manner: two infirmary men for eaeh surgeon engaged in dressing; two infirmary men for each surgeon on his visits—one to write, and the other to assist

the patient to get on the litter; four infirmary men for an operating table; and finally, eight to twelve infirmary men engaged as porters, to attend to the transportation of the wounded. It is very important to prevent the crowding of the ambulance of the trenches by soldiers whose aid is not required. A guard should therefore be placed at the door to prevent such persons from entering. In the ambulance of the division, on the day of battle, two surgeons should be on duty to receive the wounded coming from the trenches, and to examine minutely each wound. They shall make a definitive dressing in cases where an immediate operation is not indicated."

The general practice of the French surgeons in the Crimea was to extract foreign bodies from wounds at an early period, whenever they were easily accessible. The most efficient styptics in arresting hemorrhage, where the blood-vessels could not be conveniently tied, were the perchloride and the persulphate of iron. Amputations were generally resorted to in severe injuries of the limbs, and the results were more favorable than when conservative surgery was attempted. Primary amputations were much more successful than secondary. Scrive makes an exception to this rule, in the case of amputation of the hip-joint. Nine primary amputations at this joint were performed by the French surgeons in the Crimea, and in all death took place within a few hours after the operation.*

* During the present rebellion three cases of amputation at the hip-joint have been reported, of which one performed by Dr. Edward Shippen, U. S. Volunteers, was successful.—W. A. H.

There were three consecutive amputations at the hip: the patients severally lived 5, 12, and 20 days. Resections were generally fatal, except in the upper extremity. Scrive remarks, that when amputation was performed a day or two after an injury, it was much more difficult to induce anæsthesia than when the amputation was performed on the same day. The amputations were as follows: hip, 12; thigh, 1512; knee, 58; leg, 915; foot, 241; toes, 220; shoulder, 168; arm, 912; elbow, forearm, and wrist, 278; hand and fingers, 282. The average dressings for each patient were: of linen, 2482 grammes; roller bandages, 891 grammes; charpie, 1181 grammes. The weight of dressings during the campaign amounted to 196,000 kilogrammes. (A gramme is about 15 grains; a kilogramme 2 lbs. 8 oz. troy weight.) Average number of dressings for each wounded person, 35; total number of dressings, 1,400,000. Number of surgeons wounded by the fire of the enemy and by the explosion of magazine, 19. One died in consequence of his wounds. The labors of the surgeons were excessively severe. Each surgeon, on an average, was obliged to visit daily more than 100 patients. Eighty-three French army surgeons died during the war. It is very evident that the amount of labor thrown upon the medical officers of the French army was unreasonably great, and that the number of these officers should have been largely increased. When an army is called into active service, and is exposed to pes-

tilential diseases and to bloody engagements, a much larger amount of medical service is required than can be reasonably expected of a surgeon and an assistant surgeon to each regiment.

Your committee does not consider it necessary to enter into the details of the treatment which is required in gunshot wounds, and in other injuries to which soldiers are exposed, as these subjects are treated at considerable length in the text-books of surgery, which are in the hands of most of our practitioners. There are, however, some practical lessons to which a passing allusion may be made with advantage. When the attention of an army surgeon is first directed to a number of wounded persons, who have been brought from the field of battle, it is important to determine the order in which his services should be rendered to them. In order that the greatest amount of effectual relief may be afforded, certain rules may be laid down for the guidance of the surgeon under these trying circumstances. The cases to which the first attention of the surgeon should be given are not those of so severe a character as to be almost necessarily fatal; nor, on the other hand, those which are comparatively slight and unattended with danger. But his first attention should be directed to injuries which are severe and dangerous, but which at the same time afford a good prospect of recovery. The cases most urgently requiring immediate treatment are those in which there is alarming hemor-

rhage, the source of which is not beyond the reach of surgical skill. The cases next in order of urgency are those in which, from the shock of the injury, there is more or less prostration, requiring the use of cordials and stimulants. Then come the cases of compound fracture, some of these requiring amputation or resection, and others mechanical support, to prevent distortion and the irritation arising from muscular spasm, causing spiculæ of bone to penetrate the soft parts. Next in order come the slighter cases of injury of the viscera, always attended with danger, but not necessarily fatal. After disposing of those cases which are more or less hopeful, the surgeon may direct his attention to the comfort and relief of the more severe injuries, in which a fatal result is almost certain to ensue. And lastly, he may attend to the minor operations and dressings in cases of injury which are not regarded as dangerous to life.

The result of primary amputations at the hip-joint is so uniformly disastrous, that, in the opinion of your committee, these operations should be discarded from military surgery. If the patient should in any case recover from the shock of the terrible injury which seems to require so formidable an operation as amputation at the hip-joint, the operation may be performed consecutively with better prospect of success, without diverting the attention of the surgeon, at this period, from a more hopeful class of cases.

There is another subject which your committee

would bring to the notice of the surgical section of the Academy, viz., the injurious consequences resulting from the hasty removal of the sick and wounded by a discomfited and retreating army. Under these circumstances, your committee would suggest the expediency of leaving the sick and wounded, with a sufficient number of medical attendants, to fall into the hands of the enemy as prisoners of war, in all cases in which there is a large number of patients whose lives would be greatly endangered by the removal, and in which reliance could be placed on the magnanimity of the victorious party. There might be a previous understanding between the belligerent parties, that hospital buildings, or tents, so abandoned, and surmounted by a flag of truce, or some other preconcerted signal, should be safe from attack.

There is another subject to which the attention of the section might have been directed at an earlier part of the report, viz., the importance of a thorough inspection of recruits who present themselves for admission into the army. The admission of sickly and feeble men into an army is an evil of the greatest magnitude, not merely depriving the government of the services of such individuals, but exerting an injurious influence upon the health, spirit, and efficiency of their comrades. Every recruit should therefore undergo a most thorough inspection, and if deficient in the physical qualities which are necessary for a soldier, he should, without hesitation, be rejected. A

soldier should be a full-grown man, and not a boy. The most eligible age for a recruit is twenty to twenty-five years. A soldier should be strictly temperate in his habits, as intemperance is one of the most fruitful sources of disease as well as of insubordination and of crime. He should have perfect sight and perfect hearing, as a failure in either of these senses would render him incompetent to perform the duties which are expected of a soldier. He should be sound in all his vital organs, and should have a good degree of muscular development. The medical inspector should examine the recruit, divested of his clothing, investigating the condition of every vital organ, testing the sight and hearing, and subjecting the head, trunk, and limbs to ocular inspection, and to manual palpation. The condition of the urinary organs should not be overlooked, and the candidate should be required to pass his urine in the presence of the inspector. A careful investigation should be instituted with reference to the existence of hernia or aneurism. Ulcers or cicatrices on the legs, varicose veins, corns, bunions, and inverted toe-nails, should lead to the rejection of the candidate. If the inspection of recruits were more thoroughly conducted than it usually is, it would greatly add to the vigor and efficiency of our armies.

HINTS

FOR THE CONTROL AND PREVENTION

OF

INFECTIOUS DISEASES IN CAMPS, TRANSPORTS, AND HOSPITALS.

CONTROL AND PREVENTION

OF

INFECTIOUS DISEASES.

The diseases that owe their origin and diffusion to specific infectious poisons, though comparatively few in number, are the most troublesome and fatal that can afflict an army. Often have great forces been crippled, and the objects and hopes of many a campaign been defeated by such diseases; while not unfrequently the same silent enemies of military quarters, camps, and transports have humbled the proudest armies, and brought thousands of brave men to their graves, even after their arms had achieved success in the field.

The occurrence of small-pox, measles, epidemic dysentery, and typhus, in camps, barracks, or transports, and the prevalence of these diseases, together with gangrene and other infections in military hospitals, are calamities that deeply concern all persons who are responsible for the welfare of the soldier, or the efficiency of the national forces; and as it has been demonstrated, by repeated observations and varied experience, that such diseases owe their diffu-

sion and endemic prevalence to hygienic neglect, and that proper sanitary measures will not only tend to limit and prevent the prevalence of such infectious and contagious maladies, but will also diminish the severity of other diseases, every military officer needs to have a practical comprehension of the special measures required for sanitary protection under the various circumstances of exposure to disease, and to the inconveniences of army life. With this view, we submit the following *practical hints upon the means of arresting and preventing the prevalence of infectious diseases in camps, barracks, transports, and hospitals.*

The infectious maladies to which we shall particularly allude are among the most strongly characterized of the zymotic diseases, and, with the exception of a single group, the specific poisons upon which they respectively depend are unquestionably capable of being communicated from the persons sick to persons uninfected. And in the exceptional group, in which we place certain very fatal maladies, the infecting poison is, in some instances, susceptible of transportation by porous substances, or vessels with contaminated air, acting as the media or vehicles of such transmission or transportation. But, without entering upon elaborate definitions, it is sufficient that we comprehend the fact that every infectious disease depends practically upon certain specific conditions for its activity, and for the communication or spread of its infectious cause, whether to individuals or communi-

ties. The most essential of these conditions are primarily within human control, and to such conditions only does the design of this paper permit us to refer. But we do not lose sight of the fact that there sometimes exist general epidemic influences, the nature and cause of which are not fully comprehended or controlled by science, and that diseases which primarily depend upon such influences may not at all times be completely submissive to human agency. But there is good reason for believing that the material agencies by which even the most epidemic types of disease are *localized* and rendered positively *infectious* may be controlled, anticipated, and prevented, by properly directed sanitary measures.

As it is the sole design of this paper to set forth in a practical way the facts upon which effectual measures may reasonably be based for controlling the infectious maladies that most afflict armies and recruits, we propose to give to these facts the plainest possible statement, without reference to theoretical and mooted questions. And the purpose of these pages will be fully attained, if they furnish such timely and practical suggestions as the hygienic exigencies of hospitals and crowded military quarters continually demand.

The several diseases to which particular reference will be made, in these pages, may, for the practical ends we have in view, be considered in three classes, viz.:—

Small-pox . . .	Exanthematous contagions; spread by communication with the diseased person—mediately or immediately.
Measles	
Scarlatina . . .	
Typhus Fever . .	Contingently contagious and infectious diseases; perpetuated and spread both by personal and endemic conditions of hygienic neglect.
Hospital Gangrene	
Erysipelas . . .	
Typhoid Fever . .	Endemic infections, caused and perpetuated by external localizing conditions; and diffused as well as localized by the neglect of personal and local hygienic measures.
Asiatic Cholera .	
Yellow Fever . .	

First Class of Infections.

This class comprises the more important exanthematous infections. It is conceded that all these, as personally communicable poisons, or contagions, are susceptible of limitation and control by means of domestic or personal isolation of the sick, and of the things and places infected by them; but experience shows that such isolation, to be effective, especially if in the presence of strongly localizing conditions, or epidemic influences, must be vigilantly and intelligently managed. Though the essential primary causes of the exanthematous fevers are yet unknown, we may, for all practical purposes, regard it as an ultimate fact that *they are spread by communication with the infected and sick persons,—mediately or immediately.*

Small-pox.—The facts relating to this most conta-

gious malady are too well understood to need any statement of them in this paper. It is the most strongly marked type of specific poisons, and the certainty of its contagious quality and the liability of its infectious diffusion made it the scourge of the civilized world until JENNER discovered the prophylactic power of vaccinia in the cow-pock.

The value of vaccination in armies has been lucidly set forth, and in a very practical manner enforced, in a special report or monograph upon the subject, by a committee of associate members of the Sanitary Commission. Cordially commending to surgeons and commanding officers that valuable embodiment of information upon the subject of vaccination and the protection it affords, we will here quote the concluding sentences of that report:—

"1st. That primary vaccination is a positive protection, within certain limits, against small-pox. 2d. That there is a period of life when that influence declines, and that the history of epidemics teaches that small-pox will attack a variable proportion of the vaccinated if exposed to its influence. 3d. That the mere *possibility* of such a decline renders reprotection necessary. 4th. That in revaccination we have an almost infallible restorer of that protection and preventive of the spread of variolous epidemics. Hence, that revaccination in all bodies exposed to variolous contagion is *imperatively* demanded. 5th. That the operations of vaccination and revaccination are unattended with danger to those subjected to them. The committee would therefore earnestly recommend that the Sanitary Commission make such representation to the proper authorities as will secure the revaccination of all soldiers who cannot prove its performance upon them within the

previous five years; and that arrangements be made by which good vaccine virus may be distributed by their agents to the medical officers."

(Signed) Francis G. Smith., M.D., Ch'n.
Alfred Stillé, M. D.

Imperative as the duty is that every soldier and every person employed in the army should be protected by vaccination, that duty has been and will continue to be so frequently neglected and so unreliably executed that officers in charge of troops—especially if they be recruits freshly from the rural districts—will need to be watchful against the outbreaks of small-pox, and to be prepared promptly to institute effectual measures, not only of domestic quarantine for infected persons and things, but of such thorough re-examination and revaccination as may be found necessary for the permanent protection of all from the variolous infection. However thorough may have been the previous inspections and vaccinations in a given company or corps, the possibility of some defects in such duty, as well as the probabilities of the presence of new and unprotected persons, render it expedient to repeat such measures.

To officers in charge of recruits for the army, we earnestly recommend that, at the earliest practicable hour after reaching the first place of rendezvous, all men in their care be effectually protected by vaccination.

General sanitary measures, and the isolation or

domestic quarantine of patients and their clothing, should apply alike to small-pox, measles, scarlatina, and other febrile contagions; and, notwithstanding the fact that certain epidemic influences may prevail, it is not the less true that intelligently directed sanitary measures against the sources of these nuisances are sure to be rewarded with good results. The value of such measures against *typhus* and *gangrene* are popularly conceded, and the following cases will serve to illustrate the importance and utility of specific measures to limit the prevalence of exanthematous diseases in camps:—

A short time previous to the battle of Chancellorsville, a regiment of Maine volunteers had in hospital and upon its sick list upwards of eighty cases of small-pox. The same regiment had thirty men sick with measles at one time on its hospital roll at Antietam, a few days subsequent to the great battle there, in September, 1862. Orders for transportation from its first rendezvous, to join the army, were received while the measles were beginning to appear in one company. No timely and effectual measures were instituted to prevent the introduction or to limit the diffusion of either of those infections, and as a consequence many lives were sacrificed, and the military effectiveness of the regiment was thereby nearly destroyed.

In the month of December, 1862, a first-class new regiment arrived in New York, *en route* to the seat of

war, from its rendezvous in Massachusetts. A case of scarlatina appeared during the trip hither. The men were assigned to close and insalubrious quarters in the lofts of a warehouse in this city. The cases of scarlatina continued to multiply from day to day and from week to week, until nearly two hundred cases had occurred, and until one of the most promising regiments ever organized had become so broken down by this cause that the dead, together with discharged invalids, amounted to an aggregate of nearly two full companies. This regiment left its pestiferous quarters in the city, after a detention of about two months, with its military effectiveness diminished, as estimated by its veteran colonel, fully *thirty per cent.* upon its original strength of one thousand men. And it is worthy of mention here, that the local conditions that had rendered scarlatina so fatally endemic also prostrated the strength of every man, and induced various inflammatory and *typhous* maladies which broke down the health and vigor of men who seldom had known sickness previously.

In the autumn of 1862, four full regiments of nine months' men were ordered to encamp, while waiting transportation, in the vicinity of the Bay of New York, upon a plain that had already been much used as a camping ground. Measles had already appeared in one of the regiments, and soon the infection had extended to the three other commands. In one regiment only was the malady subjected to an effectual

and rigidly enforced domestic quarantine. In that camp the measles ceased with the occurrence of the second case. In the three other camps no such measures of personal isolation of the sick were adopted until upwards of three hundred cases of that disease had occurred.

In the camp mentioned, where measles was arrested, the utility of effectual domestic isolation for arresting the spread of scarlatina had been tested in a case of that disease which occurred from exposure of one of the soldiers who visited the infectious quarters of the Massachusetts regiment which we have mentioned. In this instance, the case of scarlatina was removed a short distance from the lines of the encampment the hour that the evidences of his disease appeared, and a rigid domestic quarantine of the sick man and his clothing was established. His nurse was the only other victim of the infection. After a detention of a few weeks, when these four regiments were sent forward to the field, the one last mentioned had its full quota of men; while the three others had only about two-thirds the number of soldiers who, a few weeks previously, had gone into their encampment in full health—except the single company in which the measles first appeared.

We might add other illustrative instances of the pernicious effects of the exanthematous contagions in camps, but they would all tend merely to strengthen this cumulative testimony to the hygienic utility and

military necessity of special restrictive measures for arresting and preventing the spread of this class of diseases. And what is true of exanthematous contagions, is practically, though in a modified sense, true of other diseases that depend upon specific and infectious poisons. The special sanitary measures which such poisons require for their control may all be comprised under the simple rule that—

The immediate sources of infectious poisons should be properly isolated from uninfected persons, the localizing conditions of their endemic prevalence should be removed, and every circumstance that adds to their virulence or tends to give them existence or activity, should be prevented or controlled by sanitary measures.

The statements and suggestions that follow in these pages will present practical illustrations and specific applications of this rule; and the fact will constantly appear, that such hygienic measures against infectious poisons and their immediate causes are also the most effective sanitary works for the general prevention of disease and the improvement of health.

Regarding all cases of infection and contagion, whether individual or endemic, as preventible evils, it might be claimed that they never should occur under proper medical and military administration; but as Surgeon-General Hammond has justly remarked, in his treatise on Military Hygiene, "even with every effort dictated by the most thorough ac-

quaintance with the science of hygiene, and the most conscientious endeavors to discharge faithfully the duties of his office, the medical officer of a hospital will sometimes find diseases originate under his eyes which can only owe their source to infection."

In resuming the consideration of the specific infections, it is proper to remark *in limine*, that, in the classification given in this paper, these poisons may be regarded as having widely diverse causes, operating by means of different agencies, most of which are amenable to hygienic regulations. The exanthematous poisons, though positively contagious and transportable, are measurably susceptible of preventive sanitary control; and most other infectious poisons, though more dependent upon contingencies for their operation, and therefore more difficult of such restraint, are not less submissive to it when directed by proper intelligence.

To small-pox and vaccination is due the separate consideration given in the monograph to which we have referred. Measles and scarlatina, though less dreaded, are actually the causes of greater danger and loss to the army than small-pox, for much greater numbers of soldiers are liable to the former maladies, and the sequelæ of those fevers are often fatal, or apt to produce lingering impairment of health. Hence those maladies, though popularly regarded as being simply the inevitable scourges of childhood, do actually demand vigilant measures for their prevention and control in the army.

Sanitary Regulations for preventing the spread of the exanthematous contagions.—1st. The patients and all infected things—at least, all the personal clothing worn during the period of eruption—should be immediately separated from all persons that are liable to contract or to communicate the contagion; and such domestic or limited quarantine should be enforced as will insure entire security against its diffusion. Both the nurses and the infected clothing of such persons should be treated as in quarantine. Purification of persons and places exposed to the infection should be effected by means of washing and thorough ventilation, while all clothing and porous materials must be disinfected by washing, at boiling heat if practicable, otherwise by sufficiently protracted ventilation—which, in the case of articles contaminated by small-pox, should be aided by fumigations of chlorine or bromine. And in case neither a high heat nor strong fumigations of the latter chemicals can be applied to such contaminated materials, let them be destroyed by fire. Boiling heat, or high steam, is the surest disinfectant of small-pox and all other contagions. Even a temperature of 140° F. effectually neutralizes the virus of vaccinia.

The transportation of patients having small-pox or measles should in all cases, when practicable, be provided in vehicles exclusively employed for the purpose; and in any case where an ambulance or saddle has been used for conveying a small-pox patient or

his clothing, it should be placed in quarantine until properly purified. Tents and equipage that have been immediately exposed to the exanthematous infections, should be washed with boiling water.

It should be borne in mind that a low temperature tends rather to increase than diminish the activity of the exanthematous poisons and most other febrile contagions. It is only upon the yellow fever miasma, and other infections which depend upon warmth and moisture, that cold acts as a disinfecting agency.

Second Class of Infections.

Typhus Fever, Hospital Gangrene, and Erysipelas are here grouped for consideration as infectious maladies, and sources of specific poisons that obey similar laws of generation and of prevention, and which also depend upon a given class of hygienic agencies for the mitigation of their activity.

No army surgeon can be uninformed respecting the infectious nature and the peculiar activity and perils of this class of contagions in hospitals and crowded quarters, and as even the subordinate officers in wards, and the commanding officers in military quarters, where any of these diseases are found, ought definitely to understand the requisite measures for providing sanitary protection against them, the following concise statement is here given, without ex-

planation, and at the pleasant risk of recapitulating, in a very synoptical manner, the special information and hygienic regulations which every medical officer in charge of a military hospital may justly claim as his own. Were an apology required for reiterating such statements of accepted medical knowledge, or for reducing these statements to aphorisms, we need but refer to the circumstance, "that it stands prominent as a fact in military history, that serious evils frequently arise in armies from the ravages of contagious fever; and that, as contagion is a contingent evil, it is obvious to common sense that the chances which give rise to its action ought to be precluded with every possible care."—Dr. Robt. Jackson *on Armies*, p. 368.

However excellent the plans providing for medical service in hospitals and in the field, and however well directed may be the sanitary regulations of great armies, active warfare involves the repeated and almost constant occurrence of contingencies that necessitate a choice of evils, and require much exposure to causes of disease. The crowding and accumulation of men which occur in war, tend to produce and perpetuate infectious maladies. Hospitals and transports are frequently overcrowded from the very necessities that war creates; while the regulations of encampments are made to crowd upon given areas populations more dense than can be found in any city. Our army regulations permit crowding in the

regimental camp at the rate of 86,000 men to the square mile; while in hospitals and transports the natural evacuations and bodily excretions, the suppurating wounds, the gangrenous parts, and the uncleansed persons and clothing of vast numbers of soldiers in an unhealthy condition, are combined to vitiate the local atmosphere. Under such circumstances of inevitable insalubrity, the worst of endemic infections may suddenly spring into fatal activity, and almost any imported *virus* of disease will readily become localized. It is manifest, therefore, that hygienic measures for the control and the prevention of infectious contamination will mainly consist in sanitary works for the preservation of atmospheric purity, and for the special restoration of such purity to the places, things, and persons contaminated. To accomplish this object, sanitary science commands the abundant resources of police regulations, engineering, chemistry, and medical science.

Localizing and Endemic Causes of Infections of the Second Class—Putrid Contagions.—1. Overcrowding and special hygienic neglect of wards, barracks, quarters, tents, or transports may justly be regarded as the most active and common localizing condition, and the chief originating cause of typhus, and of that state of the blood and the nervous system that primarily establishes the gangrenous process, and renders simple erysipelas malignant and contagious. Any apartment or place that has generated or localized any of

these dangerous infections should, if practicable, be immediately and entirely vacated by all sick and wounded persons; but if such removals are impossible, let there be made the best practicable distribution of patients, and election of places and apartments for them, and, as a protective measure, let no delay be made in commencing the best methods of purification. These are—

2. Thorough cleansing and ventilation, constantly and rigidly enforced;

3. The immediate and effectual employment of appropriate and most available disinfectants. The following are the best:—

In hospital wards, barracks, transports, and contaminated quarters.	Chlorine and the Alkaline Chlorides, Nitrous Acid vapor, or Bromine vapor, carefully employed; Permanganate of Potassa, Nitrate of Lead, or Sulphate of Iron (copperas); } In solution and upon evaporating cloths. Charcoal powders, Gypsum, Quicklime, or Coal-tar compounds.
For special cleansing of latrines, sewers, sinks, and other external nuisances.	Coal-tar compounds, Chloride of Lime, Sulphate of Iron, Charcoal, and Gypsum, Quicklime, or dry Earth; after proper cleansing and water-flushing.

4. The immediate removal of all surface-filth, garbage, and decomposing materials, and the drying of such localities and all wet surfaces by means of surface drainage, dry sand or earth, and desiccating with lime or charcoal if at hand.

5. Order such improvement in the ventilation of all occupied apartments as will insure the steady supply of *not less than from twenty to forty cubic feet of fresh external air to each person every minute by day and by night.* Also let into all places an abundance of sunlight.

6. If the infected quarters or place must continue to be occupied many days, institute a system of thorough and deep drainage of the entire locality; also take measures for securing the best water-supply.

7. From the first, and continually, call into operation all proper means for increasing the cheerfulness, hopefulness, and general *morale* of all patients and attendants, and let all the principles of hygiene be brought into their fullest operation in the persons and apartments, and throughout the entire locality in which endemic infection prevails or is liable to prevail.

Special Hygienic Management of Patients and Wards: Ventilation, Disinfection, Distribution, Isolation, etc.

1. Avoid allowing more than one of the types or kinds of really infectious disease at one time in the same apartment. This rule is particularly important in managing the infectious diseases comprised in the second class.

2. Prohibit the accumulation of large numbers of patients suffering from these maladies in one apartment or upon a small area; and if ever it should be

necessary to have anything like the usually allotted number of patients in a ward, let the ventilation of such an apartment be improved and kept in the most effectual operation. When practicable, there should be an allotment of from 1500 to 2500 cubic feet of air-space to each patient in such a ward.

3. The most scrupulous cleanliness should be rigidly enforced in everything that pertains to the patients and to their apartments. In no case should a sponge or towel, or any article of clothing that has been used upon one of this class of patients, be used upon any other patient, unless the article so employed has first been effectually cleansed and boiled. All such contaminated articles must be treated as being held for the time in domestic quarantine, and they should not be released from such rigid restrictions until after having been washed and subjected to a boiling heat, unless treated by direct application of vapor of bromine, chlorine, or permanganate of potash in solution. The attendants upon the sick with these maladies should give scrupulous attention to personal cleanliness.

4. Thorough dryness should be always enforced in the sick-room; the floors should be dry-cleaned, and the local atmosphere specially desiccated by means of strong through-and-through air currents, or, in the absence of such ventilation, by the use of special *dryers*, e.g. quicklime, or sulphuric acid, distributed on shallow plates; or very dry sand laid as a coating

on the floors, and frequently removed. On shipboard with infectious diseases, such *drying* of the local atmosphere is of special importance; and it is proper to remark that the writer has succeeded best in securing such desiccation by means of *special* ventilation, dry-cleaning the floors, and the free use of dried sand coatings, with the employment of quicklime, etc. as here mentioned.

5. Patients with other diseases should not be permitted to visit wards devoted to typhus or other infectious maladies; and in guarding against the spread of any of the infections, of the second as well as of the first class, there should be no unnecessary intercourse between the apartments assigned to the different diseases.

6. Whatever other diseases or surgical cases may, from necessity, be suffered to remain in the same ward, or upon the same floor with the second class of infections, all unhealed amputations or open wounds must be kept out of their presence and beyond their influence.

The universal experience of military surgeons and officers of hospitals has shown how indispensably important it is that a reasonable and effectual system of domestic and personal hygiene, based upon the principles and maxims here stated, should be intelligently enforced wherever the infectious pests of armies spring up. And it may be remarked, that the same localizing conditions and the same sanitary neglects that

we have mentioned in reference to the most virulent of endemic febrile infections, seem to be equally as active and fully as important in the production and endemic diffusion of the causes of camp dysentery and the fatal diarrhœal affections that follow in the trail of armies. And whether personally communicable or not, the latter maladies are often seen to be as much dependent upon endemic and localizing causes, in hospital wards and other localities, as typhus and hospital gangrene. Were we to group that class of maladies for consideration in these pages, we might properly place them in a separate or sub-class, and regard them as being somewhat allied to both the second and third classes of infections. The maladies here referred to, when occurring in crowded military quarters, transports, or hospitals, should be regarded as being contingently infectious. In these diarrhœal maladies it is admitted that the dejections from the bowels tend to perpetuate and spread the same maladies. And this process may properly be denominated infectious, though there is not as definite a period of *incubation* as that which characterizes the febrile types of infection.

Third Class of Infections.

At the risk of some just criticisms upon this classification—an arrangement adopted solely for a practical object—we have, for the occasion, grouped to-

gether the three remarkably distinct and fatal diseases—*typhoid fever*, *cholera*, and *yellow fever*.

Whatever may be true and whatever doubtful in the history of these maladies as regards the mooted question of *personally* infectious qualities, that question is so involved in indefinite contingencies and consequent doubts, that it is practically of very subordinate importance. It is only necessary to our purpose to refer to the causes that tend especially to localize and to perpetuate these maladies. Dependent upon widely different sources, these diseases agree in their dependence mainly upon *external* agencies, and in a manifest tenacity of their specific poisons or infection in the locality in which they respectively become localized. They are emphatically endemial maladies, and cholera claims also to be the type of an epidemic of widest range; but when localized, the infected locality of any one of these is a place of danger. This is most emphatically true of the specific and unknown cause of yellow fever, and is, contingently, not less true of the most active causes respectively of cholera and of enteric and typhus fevers. And it is demonstrated by experience that, to give sanitary security against these dreaded diseases, the causes of their infectious poisons must be removed, or, otherwise, that all susceptible persons, tarrying or visiting such infected places, must be prohibited therefrom. All effective sanitary regulations for controlling and preventing these diseases

have both these necessary conditions of security in view.

The separate consideration of the leading points, to be kept in view in the sanitary control of each of these maladies, will set forth this subject in a practical light.

Typhoid or Enteric Fever.—Various morbid agencies are usually combined in producing this fever, but we will specify that which is most important and widely acting, and which is most directly connected with the question of a specific infectious cause. This has been denominated by Dr. Murchison the *pythogenic* infection, or the specific miasm of sewers and neglected latrines—the pest of camps and badly drained towns. Says Dr. J. B. Upham, in his report upon this fever, published by the U. S. Sanitary Commission: "Its essential causes are by no means well ascertained. * * * Among the immediate causes must be named the ordinary excitants of disease in camps."

The fact is now well ascertained that this fever is, under certain contingencies, infectious, and communicable through the agency of the bodily excretions of the sick; but the greater truth is, that effete animal and organic matter in a state of putrescence, as in badly policed camps, barracks, and latrines, and especially the mephitic effluvia from sinks, etc., are the most powerful localizing causes of its endemic prevalence.

Special Sanitary Measures.—1st. Remove from the pestilent locality the sick, and as many other susceptible persons as practicable, and place them in salubrious quarters.

2d. Wherever patients with typhoid fever are placed, let effectual measures be instituted to remedy overcrowding, filth, humidity, neglected bodily excretions, latrines, sinks, sewers, and all other causes that tend to augment and localize the infection of this malady as an endemic.

3d. In general, pursue the same course of hygienic care and sanitary police as in typhus, but with greater care, if possible, to abate external nuisances, and comparatively less concern for any degree of absolute isolation of the sick persons. The alvine dejections and the chamber vessels, previous to exposure, should be treated with some prompt disinfectant. This must be attended to in all diarrhœal diseases.

Cholera.—With as limited and even less certain knowledge of the essential causes of cholera, the laws which govern its endemic prevalence are perhaps as well known as those that relate to typhoid fever. And without the least evidence of correlation of these maladies, or their essential causes, still it may be remarked that the same conditions of hygienic neglect tend to localize either malady and to perpetuate its infectious power, when a foothold is

once obtained. The same sanitary measures apply to both,—with this remark, that there is more urgent necessity for immediately removing all uninfected persons from places where cholera is really endemic. It is also, perhaps, more urgently important, in the case of cholera, that the evacuations from the stomach and bowels should be instantly removed and carefully kept from exposure in any way to other persons than the patients themselves.

The same disinfectants are required as in the management of the second class of infections; especially should there be a free application of quicklime or the alkaline chlorides in the immediate control of all excretions from the patients, as well as for the preservation of atmospheric dryness and purity. The ventilation of hospital wards and all infected places should be as perfect as possible.

Yellow Fever.—Infected *places* and infected *materials*, not the persons suffering from this fever, are the recognized sources of danger. The question of a specific infection or poison seems in this instance to relate mainly to *locality*, and to porous and retentive materials from an infected place.

The facts relating to the nature and treatment of yellow fever are concisely and well stated by Prof. J. T. Metcalfe, in his valuable little monograph published by the Sanitary Commission. The few facts that demand specific notice in this place in reference

to the control and prevention of the infection of this fever may be stated as follows:—

1. The infecting cause of yellow fever may be conveyed from place to place by vessels and by porous and retentive materials of various kinds that have been exposed in places where this fever is endemic, or that have elsewhere become contaminated by the presence of infected materials.

2. The positive means for destroying the infecting cause or specific poison of this malady are, *first*, a freezing temperature; or, *secondly*, a temperature of 212° F.—boiling heat; *thirdly*, destruction of the infected things by fire.

Any of these methods may be employed to destroy the infecting poison which clings to vessels and things—the second method, by means of a boiling heat, being the most available and probably the most certain in its operation. [*See Special Report on Heat as a Disinfectant. Proceedings of the National Quarantine and Sanitary Convention*, 1860.] But the first method—cold—is nature's sure means of destroying the endemic cause of this tropic pestilence, and it is alone competent to the work of instantly terminating its prevalence in any given district of country.

3. The localizing and endemic causes of other zymotic maladies seem to augment the virulence of yellow fever, and in regions specially liable to this fever, hygienic neglect may justly be regarded as an important tributary cause of its endemic prevalence.

So true is this on shipboard, that not unfrequently this pestilent malady breaks out with great virulence as soon as the unclean vessel reaches the region or zone in which it is possible for yellow fever to prevail.

4. The immediate removal of the entire population—excepting only those persons that have once had the fever—from the infected locality, is the first and most necessary sanitary measure to be adopted in any place, when yellow fever has become endemic; and this protective measure is equally important in a single apartment or building, a particular compartment, side, or deck of a ship, or in an entire street or neighborhood that has become infected.

5. Regulations to prevent unnecessary intercourse with infected places may, in particular instances, be essential to protection against the distribution of materials that would communicate and spread this fever, which naturally tends to limit itself to definitely bounded localities. As Dr. Metcalfe very justly says, in the report mentioned on a preceding page: "To abandon quarantine restraints on yellow fever, is to place a price on human life and barter it for trade."

Sanitary Measures against Infectious Diseases in Transports and Crowded Quarters.—In the foregoing pages we have endeavored to convey a correct idea of the paramount importance of intelligent and unceasing attention to personal and local hygiene, whatever

may be the special measures required for preventing the activity or spread of infectious poisons.

Purity of the local atmosphere, and proper cleanliness of person and of quarters can be preserved in hospitals and transports only by the most vigilant effort and exact discipline. In hospitals, the vitiating influences are peculiar and numerous. Said Baron Larrey, before the French Academy, last year:—

"The natural excretions of the patients, their fetid breath and perspiration, the expectoration of gases and liquids, alvine dejections, evacuations, and urinary fistulæ, all these joined to accidental secretions, the suppuration of wounds and ulcers, and the putridity of hospital gangrene, are so many mephitic beds from which may arise the most formidable epidemics in field and general hospitals, on the trail of armies in campaigns, exhausted by all the fatigue and privations of war; and, above all, in the disastrous conditions of crowding," (*encombrement.*)

We need not enumerate the sources of a vitiated atmosphere and consequent endemic infections in camps and barracks; they are known to every soldier. M. Baudens's remark, that the infection of fever in the Crimea "had one foot in the camp and one in the field hospital," is fully explained when he states that "the quarters for troops shine with the greasy filth of daily neglect," and that "on review day, the fine battalions left, as they passed, the marked and well-known stench of the barracks."

In transports, whether with troops for the field, or with sick and wounded men, the perils of overcrowd-

ing, bad ventilation, uncleanliness, bad diet, and want of exercise, combine to induce the worst degrees of infection, and to diminish the vital powers of all who suffer such privations. Fortunately the greater part of the water transportation during the present war has been by the river and bay steamers, whose ample decks and open ventilation have been the best of safeguards against the diseases that most infest transport ships. Yet even at this stage of progress of the national arms southward, numerous instances have occurred which illustrate the peculiar perils of transports even under favorable circumstances. The following passage is from the report of Surgeon J. H. Brinton, upon the hospital gangrene in the Western hospitals. In his special report to the Surgeon-General, Dr. Brinton says:—

"The development of this disease on the route seems to have been owing to the fact that the transportation of the wounded was effected by means of crowded and ill-ventilated boats, and that the trip by the Cumberland and Ohio rivers frequently occupied several days. During this time these patients, who had already undergone much suffering, were exposed to all the influences most apt to engender this disease. In contrast with this fact, it was found that, as soon as the Louisville and Nashville Railroad was opened, so that the wounded could be conveyed from city to city in one day, all importation of gangrenous sores into Louisville ceased. The development of hospital gangrene during the boat transportation is a noticeable fact, and is strikingly analogous with the same phenomena observed among our paroled wounded prisoners from Richmond, received into the Annapolis General Hospital some months since."

In the transport ships for troops upon the sea-coast and the Gulf, the evils of crowding, lack of ventilation, and the presence of infectious diseases have already produced serious results in a number of instances; and, as the war progresses, there will be constantly increasing necessity for much greater care in the sanitary management of such transports. Especially is an intelligent medical supervision of the transports now needed, to guard against the introduction and spread of the infection of typhus fever, which has again obtained foothold in our cities. The perils to which the patients in military hospitals both at the North and the South will be exposed when typhus gains access to them or to the transports, would be greater than all the casualties of battle or of the sea. Already the fact has become too apparent that the insalubrious condition of the returning transports is localizing and extending the prevalence of typhoid fever and dysentery.

The practical importance of this subject, as well as the peculiar exigencies of the transport service, justify the following brief suggestions upon the hygienic management of transports with reference to the prevention of infectious maladies. These suggestions the reader will please regard merely as practical applications of principles already enunciated in the foregoing pages.

The points that demand consideration concerning hygienic management of transports are:—

1st. Those that relate to the vessel; previous to embarkation, and subsequently, when crowded with passengers.

2d. Those that relate to the soldiers; previous to embarkation, and subsequently, while they are on board the transport.

The Transport.—Cleanliness of the vessel; this is an essential point, and it will seldom be properly attended to before the embarkation, unless the medical officer intelligently advises the proper authorities upon the subject. Transports that have been long in service, and upon voyages of several days' duration, need to be frequently and thoroughly cleansed, and all the spaces between decks and to the very keelson, should be limewashed. Transports upon which any infectious endemic has recently prevailed, should either be thrown out of service, or be subjected to such processes of cleansing, fumigation, and ventilation as will remove all local infection. Chlorine, nitrous acid fumes, or bromine may very readily be used for this purpose; and, in the case of yellow fever infection, if such a transport must be employed before it can be sent to the region of frost, its spaces should all be flooded with superheated steam. Water should be abundantly supplied in sound casks and tanks, and of as good quality as can be obtained. If it contains much organic matter, let freshly burned and clean charcoal, or the permanganate of potash, be supplied for use in its purification. Of buckets and

lavatories let there be full supply on deck, that it may be practicable to enforce the proper observance of personal cleanliness. When soldiers are detained several days upon transports, great advantages will be attained in personal health and comfort, no less than in respect of protection against endemial and infectious agencies, by the habit of daily ablution of the entire body. Water-closets and spouts must be amply sufficient and properly arranged, even for short voyages, or the most offensive sources of disease will be sure to exist. A transport should have means of effective through and through ventilation, from the bows to the stern, and from the upper deck to the keelson, and this is provided in some measure by the ship's hatches, gangways, and counterports; but the special improvements or works for ventilation in ordinary transports, consist mainly in greatly increasing the area and the places of *egress for foul air*. This is best effected, temporarily, by increasing the area of the windows and air-shafts at the stern, and, if admissible, elsewhere. The *ingress of fresh air* is easily provided for after establishing the channels and amount of outlet. Wind-sails for ingress can be multiplied indefinitely, and when no properly made wind-sails are at hand, any sailor can rig studding-sails for the same purpose. Each deck must have its independent channels for supply of fresh air, and for the egress of foul air. The lower or closed decks of steamship transports should have

shafts or *areas* of outlet for foul air, at least equal to *four square feet* for every 100 men. The total area of the fresh-air *inlets* should considerably exceed that of the foul-air *outlets;* and upon the proper adjustment of the outlets and the intelligent management of the inlets depends the problem of extemporized means of ventilation in ships. The estimate given above will provide 1000 cubic feet of fresh air per hour to each man, in a vessel sailing five knots an hour; but, if no special outlets are provided, even twice the number of wind-sails, all injecting, would fail to supply at the rate of 100 cubic feet per hour. So simple are the principles of naval ventilation, that with the aid of an intelligent shipmaster, temporary means for effectual ventilation may be instituted, without cost or delay, in any transport. The proper management of the ventilation, together with the strict cleanliness and police of the ship, are indispensable every hour that soldiers remain upon a transport.

Sanitary Regulations for Soldiers upon Transports. —Previous to embarkation upon outward voyages, there should be an inspection to prevent any infectious or other important disease from being brought on board, and every man should be vaccinated, or exhibit evidence of previous vaccination. In embarking sick and wounded men, the same vigilant caution should be exercised to exclude infectious diseases from the transport; and when any infectious

malady must be transported by water, a special compartment, or an entire ship, should be provided exclusively for that purpose. The practical importance of these rules cannot be overestimated when typhus and hospital gangrene are rife. The question as to which part of a transport should be selected for the isolation of infectious cases of disease, may best be determined by the officers in charge. Dr. Robert Jackson recommends the section under the bows of the ship; and, in a sailing vessel, that may be best; but in transports, propelled by steam, the stern of the ship is probably best. It is particularly important that the sick-bay or hospital have a separate gangway, and ready access to the galley; also, that it be furnished with a portable culinary apparatus, and with air-tight close stools. And especially must the sick-bay have independent and ample means of ventilation, and be suitably lighted. Personal cleanliness, and rigid sanitary police, in all that affects personal habits, clothing, diet, and exercise, are so peculiarly important on shipboard, that all regulations and penalties relating to this subject should be rigidly enforced. Any inattention to these things, on the part of medical officers, and any letting down of military and police authority, might prove more fatal than the casualties of a battle-field. The special management of the sources of infection, whether they be indigenous or introduced, upon transports, should conform to the principles that have been stated in the

former part of this paper; and it is vitally important that there should be the greatest fidelity and vigilance in the supervision and execution of all the details of sanitary regulations for this purpose. Especially must the most scrupulous cleanliness of the men and their clothing, their habits and their quarters, be enforced by military authority; and, at stated periods of the day, every man who is not in hospital should be compelled to vacate the 'tween decks, to take exercise in the open air, and the disposition to hybernate in sloth and neglect must be effectually opposed; while such cheerful exercise and games as can be permitted should be encouraged.

As in hospitals and crowded barracks, so in transports, the problem of sanitary security is the problem of abundant air-supply, cleanliness, local purity, and general obedience to physiological laws.

Although the infectious types of disease have not yet prevailed very extensively among the national forces, it is to be expected that the greater hardships and perils of campaigns now commencing, together with the attendant insalubrity of climate and localities, the crowding of hospitals, transports, and quarters, and greater exposure to special sources of infection in the South, will demand the most intelligent attention of medical officers to the questions presented in these pages. But if timely and effectual sanitary measures are adopted, and every controllable source of pestilential infection or general disease is antici-

pated by preventive means, our vast armies will certainly be spared the sweeping pests of typhus, camp dysentery, and hospital gangrene, and be protected from the scourges of scorbutus, typhoid fever, and cholera,—diseases which in all European armies have proved far more destructive than all the projectiles and sabers of the enemy.

APPENDIX.

SPECIAL DISINFECTANTS AND THEIR APPLICATIONS.

That there can be no substitute for *fresh air* to meet the physiological requirements of respiration and health, should be indelibly impressed upon every mind. Better that all substances at present employed as disinfectants and deodorants were at once prohibited by the Medical Department than that such agents should practically tend to be regarded as *substitutes for a pure atmosphere.* But the necessities and privations of army life, the multiplied agencies of disease, and the vitiating conditions attendant upon wounds and sickness, create necessities for the employment of chemical and other artificial agencies to mitigate, and, in some measure, prevent the otherwise inevitable contamination of the local atmosphere of crowded hospitals, transports, and quarters; and it is only such necessary demands for the employment of disinfectants that justify even the occasional allusion we have made respecting them in preceding pages. They are simply aids in restoring and preserving healthful purity, and not substitutes for cleanliness and pure air.

For the convenience of persons who may have occasion to re-

fresh the memory with the more practical facts relating to special disinfectants, and the best method of their application, the following notes are added in reference to this subject.

The principal disinfecting agents may be classified as follows:—

Absorbents and retainers of noxious effluvia, particularly the ammoniacal and sulphuretted gases.	Charcoal, Sulphate of Lime, (Plaster Paris,) Sulphite of Lime, Silicate of Alumina (Porous Clay.)
Absorbents of moisture; chemical agents that act upon organic matter, and recombine some of the elements of noxious effluvia.	Quicklime, Sulphuric Acid, Hydrochloric Acid, Nitric and Nitrous Acids.
Soluble salts that are particularly available for arresting processes of decomposition, and for controlling phosphuretted and sulphuretted gases.	Nitrate of Lead, Chloride of Zinc, Proto-chloride of Iron, Proto-sulphate of Iron.
Antiseptics that act diffusively and rapidly, though less permanently than some others. Active in destroying compound gases.	Chlorine Gas, Hypochlorite of Soda, (*Labarraque's solution.*) Chloride of Lime.
The most prompt and efficient antiseptic known.	Bromine.
Antiseptic, and of great power as an oxidizer, and as an available source of ozone.	Permanganate of Potassa.
Antiseptic and deodorant: capable of a great variety, extent, and economy of applications, and acting with considerable energy and permanency.	Carbolic Acid and Coal-tar compounds.
Destructive of contagious virus and all transportable infections.	Heat.
Destructive of Yellow Fever miasma, and of the malaria that produces the "Paludal Fevers."	Frost.

Considered *theoretically*, we may regard all disinfecting agents under the following heads, and perhaps this would be the more

scientific arrangement of them: 1. *Absorbents of moisture and of noxious effluvia;* 2. *Oxidizers* [ozone the most active] *and Deoxidizers;* 3. *Other chemical agents that break up noxious compounds;* 4. *Agents that form indestructible compounds with putrescent materials; or that destroy cell-life and the cryptogamic and infusorial organisms.* But as the present state of chemical and medical knowledge only enables us to make such general statements respecting the theoretical action of disinfectants, we will follow our first classification by a few practical statements concerning each of the articles mentioned.

Charcoal.—Freshly burned and broken, this substance will absorb from 10 to 14 *per cent. its own weight* of gases and moisture from the atmosphere during the period of 24 hours; and it is capable of absorbing 90 times its own volume of ammonia, or 55 times its own volume of sulphuretted hydrogen. Properly applied, charcoal is an arrester of putrefaction, and, as such, it is worthy of more extensive employment in the better preservation of animal food when served out in an unwholesome state by the regimental quartermasters. As a disinfectant or deodorant for extensive use in masses of putrescent material, and for local purification, fresh charcoal is of acknowledged value. The British Sanitary Commission, in the Crimea, ordered whole ship-loads of peat charcoal, which they used in the progress of their work of purification in the hospitals, barracks, or camps in the East. A Report of that Commission states that "perhaps the best deodorizing compound was one used by the inspectors in all their works. It consisted of *one part of peat charcoal, one part of quicklime, and four parts of sand or gravel.*" It should be remembered that the preservation of the disinfecting power of charcoal powder depends upon its being both fresh and dry.

Sulphate of Lime, Sulphite of Lime, and Porous Clay.—All these substances are valuable absorbents of ammoniacal and sul-

phuretted effluvia, and they constitute exceedingly convenient vehicles and auxiliary menstrua for some of the more potent and expensive antiseptics. The much-vaunted French disinfectant, known as the disinfecting powder of Messrs. Corné & Demeaux, consists of about 94 per cent. of finely ground gypsum and 5 or 6 per cent. of coal-tar or the "heavy oil of coal-tar." McDougall's powder and the Ridgewood disinfectant consist of carbolic acid combined with the sulphate of lime and porous silicate of alumina respectively, as will be noticed upon a subsequent page. Hyposulphite of lime possesses the property of absolutely arresting fermentation or the catalytic processes. The several substances of this first class, and their compounds, particularly those with carbolic acid or coal-tar, are among the most valuable disinfectants, especially when large quantities of cheap and effectual articles of the kind are required.

Quicklime.—With sulphuretted and with phosphuretted effluvia, and with humid vapors, freshly burned lime unites with great avidity, and as an absorbent of moisture and a chemical base for many acids, it is of peculiar value; but lime also eliminates or sets free the ammoniacal gases, and, like the acids of our second class of disinfectants, it is of *less permanent* value than some other agents. It is one of the most convenient antiseptics, and for local applications, as in whitewashing, sprinkling, desiccating damp surfaces or putrescent substances, and for temporarily arresting putrefaction, it is invaluable. Lime should be used dry and unslacked, except it be for the special purpose of combining with carbonic acid gas; for the latter object it should be reduced to a creamy hydrate, and, in overcrowded wards and barracks, it may be usefully employed in this way, distributed in shallow plates. Distributed in like manner, *sulphuric acid* may be employed for diminishing the humidity of the atmosphere in a closed and damp apartment; but for this purpose it is usually better to resort to strong currents of air, by means of through and through ventilation, when practicable.

The topical applications of the acids, particularly of the *nitric acid*, in arresting gangrene, are well understood by surgeons. *Nitrous acid* is a valuable antiseptic, and the production and application of its fumes constituted the famous disinfecting process of Dr. Carmichael Smyth.

The *fumes of nitrous acid* that so long had fame for disinfecting purposes in the barracks, hospitals, and navy of Great Britain, may be readily produced by heating a mixture of nitrate of potassa and sulphuric acid in an iron or porcelain dish. Persons who resort to this method of fumigation, should bear in mind the fact that strong fumes of nitrous acid are dangerously irritating to the throat and lungs. These fuming acids are powerful oxidizers, but their avidity for water, together with their peculiarities of chemical affinity, render their value as disinfectants somewhat uncertain.

Nitrate of Lead.—Practical considerations place this salt at the head of odorless disinfecting salts most available for certain local applications, such as deodorizing a close apartment, and the bedding, etc. of sick persons, by means of a solution distributed on shallow vessels or upon saturated cloths. The nitrate of lead is the basis of "Ledoyen's liquid."

The *permanganate of potassa* is far the most efficient salt of this kind, and its cost alone should limit its employment. It is a chemical agent of different and far greater powers than any of the metallic salts in this third class.

Chloride of Zinc.—Though more powerfully antiseptic than nitrate of lead, it is not as valuable a deodorant. It is most to be valued for its property of promptly arresting putrefactive processes. As "Sir Wm. Burnett's disinfectant," it is widely known.

Both this salt, and that of lead, last mentioned, may be employed to delay decomposition in a corpse, in the absence of an embalmer. This is best accomplished by wrapping the dead body in a folded sheet that is saturated with either of these salts.

The Proto-chloride and the Proto-sulphate of Iron.—These are valuable and very cheap agents for aiding in the control of ammoniacal and sulphuretted effluvia. Being soluble, and very cheap, these salts are capable of varied and convenient applications, separately or in combination with other deodorizing materials.

Chlorine and its alkaline compounds.—The common preparations of chlorinated soda and chloride of lime act with great efficiency when the carbonic, sulphuretted, or ammoniacal gases are brought into contact with them. As their special uses require no explanation in this place, we simply append brief directions for generating chlorine gas where it may be required more immediately and copiously than it would be given off by the alkaline chlorides or hypochlorites.

Ready method.—Pour dilute hydrochloric, sulphuric, nitric, or acetic acid upon chlorides of lime, zinc, or soda. This may be done gradually by means of a glass or lead syphon, or by the capillary syphon of lamp-wick, dropping the acid upon the chloride, if desirable to evolve the chlorine steadily for many hours.

Cheap method.—Mix 6 parts of peroxide of manganese with 8 parts of table salt (chloride of sodium) in a lead or iron vessel, which should be set freely within another vessel of larger capacity; pour upon the mixture of manganese and salt 13 parts of sulphuric acid, which may be diluted with water to abate the rapidity of the evolution of the gas. Heat the vessel containing this mixture by means of hot water or steam, if more rapid evolution of the gas is required.

Ordinary method.—Mix 4 parts of fuming hydrochloric (muriatic) acid with 1 part of coarse powder of peroxide of manganese, adding water, as may be desired, to abate the rapidity of evolution. Apply moderate heat. The vessel may be of a kind to permit the use of the acid and the heat. The heat, however, by this method, is not indispensable.

A very neat method of evolving chlorine in hospitals and transports, is to put a few ounces of the black oxide of manganese into a stout glass bottle of large size, rig a bulbous pipette to a perforated cork or stopper, and fitting an India-rubber bulb upon the headless bulb of the pipette, fill the pipette with muriatic acid, and evolve the chlorine at pleasure by occasional pressure upon the elastic cap.

Bromine and its compounds.—This most powerful antiseptic has recently been brought into requisition in the military hospitals as a special disinfectant and arrester of gangrene. It is applied both topically and diffusively. Bromine is exceedingly penetrating and energetic in its action, and consequently is to be manipulated and applied with proper caution. It is principally employed in its pure liquid form, or in combination with bromide of potassium. Special caution should be used not to respire the strong fumes or any pulverized compound of bromine, as its effects when inhaled are suffocating. The following concise statement of the best methods for applying this potent disinfectant, we quote from Dr. M. Goldsmith, U. S. Vols., Medical Director of Military Hospitals at Louisville, Ky., to whom the medical profession is largely indebted for its successful introduction as a topical and prophylactic agent for the control of hospital gangrene and erysipelas:—

Directions for Use.—1. *For Fumigation.*—Place vessels, containing *one ounce* of the solution, at different points of the ward, and in number sufficient to secure in the latter the constant presence of the odor of bromine.

It should be borne in mind that if the vapor of bromine comes in contact with the vapor of water, hydro-bromic acid is formed; therefore, when there is much of the vapor of water disengaged in the apartment, the quantity of the vapor of bromine must be correspondingly increased.

2. *Topical Application of the Vapor.*—A piece of *dry* lint is

to be placed over the diseased part; over this is to be placed another piece of lint *moistened with the solution of bromine;* over this, a *third* piece *spread with simple cerate;* the whole to be covered with oiled silk and bandage, so arranged as to retain the vapor in contact with the diseased surface as long as possible. The solution is to be removed as often as it becomes exhausted by evaporation.

3. *The Solution, in Substance, as a direct Application, in Hospital Gangrene, Diphtheria, Gangrene of the Tongue, and other Diseases of this nature.*—The parts are first to be dried by the application of charpie; then the sloughs, if thick, should be trimmed out with forceps and scissors as much as possible, for the thinner the slough the more effective is the remedy. The parts having again been dried, the solution is applied by means of a mop, or a pointed stick of wood, in quantity sufficient to saturate the sloughs. If the sloughs undermine the skin, or dip down into intermuscular spaces, the solution must be made to follow, with the pointed stick, or by means of a glass syringe.

If the application has been effectual, all odor from the diseased surface ceases, and the sloughs become somewhat hardened. The remedy should be reapplied every second hour, as long as any odor of putrefaction is present, or as long as the sloughs appear to be diffluent. It is not always necessary, especially when the sloughs are diffluent and thin, to use the solution in its full strength; it may be weakened by the addition of water, as the disease subsides.

The points to be especially attended to, in the use of the solution of bromine, are two: 1. The solution should be applied in strength and frequency sufficient for the impregnation of *the whole of the sloughs;* 2. To secure this end, the application *should be made by the surgeon himself,* and never be trusted to a nurse. If the sloughs are thick and cannot well be trimmed, the bromine may be introduced into the thickness of the slough by means of a hypodermic syringe.

After the topical application of the solution, the parts, when so situated as to render it practicable, should be subjected to the influence of the vapor. (See par. 1.)

Surgeons will do well to bear in mind that bromine is a new remedy for the purposes indicated above. The directions for its use, given here, are those followed in the military hospitals of this city; it may be found advisable to modify them as experience with the remedy accumulates. It is, therefore, earnestly recommended that the subject be studied diligently, that the effects of the remedy be carefully watched, and that the application be varied as new facts are developed in its use.

The investigation of the evidences respecting the antiseptic and prophylactic powers of this new disinfectant has reasonably confirmed the opinion of its great utility. But to secure its beneficial effects, its application should be made with proper care and thoroughness. It claims to arrest the destructive progress of gangrene, erysipelas, etc., and utterly to destroy the personal and the diffused virus of such maladies. To accomplish this effectually, the bromine must be applied to every molecule of the virus, and this is to be effected by means of the pipette syringe, the pointed stick, the scissors, and the solution, for local applications; and by its pungent and volatile vapors in wards and other infected places. This disinfectant certainly promises to be a great boon to our military hospitals.

Permanganate of Potassa.—A special order from the Medical Bureau at Washington [*Circular, No.* 12] calls the attention of medical officers to "the virtues of permanganate of potassa as a disinfectant and deodorizer." This is a soluble substance peculiarly convenient of application and remarkably certain and efficient in its effects as a disinfectant. Its employment as a deodorizer and prophylactic is limited mainly to topical applications, to gangrenous parts or putrescent materials, and to general effect

upon the atmosphere of contaminated apartments, by means of evaporating cloths saturated with a strong solution of the permanganate. The oxidizing and antiseptic effects of the permanganate of potassa upon organic and putrescent matter are remarkable. It is the most sensitive test for the presence of organic matter, which it oxidizes with wonderful facility. [*See remarks upon this subject in Hammond's Hygiene.*] As this is an expensive and delicate substance, it is to be employed economically, upon saturated cloths or in dilute solutions upon plates. For purifying offensive water for purposes of beverage, etc., a standard solution should be dropped into the vessel of water, *until the tinge of the permanganate begins to appear.* The rapid and effectual oxidation of the organic (*putrid*) elements of impure water and other substances, even of the atmosphere itself, when brought in contact with solutions of this salt, and the consequent and almost instant deodorization of such impurities, render this disinfectant of priceless value for practical purposes. And as all preparations of manganese are therapeutically tonic, probably the minute quantities of this salt that would be taken in drinking the water purified as above described, would only act beneficially. "Condy's Disinfectant," "Darby's Fluid," and all the vaunted preparations of "Ozonized water," etc. are but solutions of permanganates. The salts are cheaper and more reliable than such nostrums, and are now supplied by all medical purveyors in the army.

Coal-tar compounds—Carbolates.—The carbolate of lime has been employed to some extent in our camps and hospitals. McDougall's powder consists of carbolate of lime, sulphite of lime, quicklime, etc. The Ridgewood disinfectant consists of carbolic acid, proto-chloride of iron, etc., combined with fullers' earth. Either of these, which are furnished by the medical purveyors, appear to be quite as valuable as the more expensive article of MM. Corné and Demeaux, which is used at the Impe-

rial Camp at Châlons, and was found highly serviceable by Baron Larrey, after the great battles of the late Italian campaign. Coal-tar, in almost any form, is available for disinfecting sewers, etc., and in the dry powders mentioned it is available for delaying the process of decomposition, whether in a corpse or in refuse material. Carbolic acid has the antiseptic powers of creosote, and is largely sold for that article. The antiseptic properties of coal-tar, its effects upon mephitic gases and putrescent material, the permanency of its operation, and the cheapness of the article, render it available for extensive application in neutralizing and arresting cloacal and noxious effluvia in the processes of animal decomposition. A distinguished Medical Inspector of our army, when cut off from ordinary medical supplies, effectually and quickly abated the nuisances pertaining to an extensive old fortress, by means of an extemporized mixture of coal-tar procured from the gas-works upon the premises. For use in chamber vessels, close stools, etc., a neat fluid preparation may be made, after the formula of M. Demeaux, by mixing equal parts of coal-tar, alcohol, and hot soft soap. With the progress of knowledge respecting the chemistry of coal-tar and other hydro-carbons, the precise value of this class of disinfectants will be better understood. Coal-tar certainly has remarkable efficacy in arresting putrescence and controlling its effluvia.

Heat.—As a means of immediate disinfection of contaminated garments, bedding, and even of close apartments, ships, etc., heat is at once a cheap and most effectual method. The boiling of infected clothing, etc. is admitted to effectually destroy any contagious poison. And practically, upon a large scale in such work, experience proves it is best to employ steam as the means of heating. Upon this subject, see remarks and plans of M. Baudens, [*Hospitals and Health of Troops*, Am. ed., pp. 138–204;] also, a Report on Heat as a Disinfectant, in the Transactions of the National Sanitary Convention, 1860. It is probable that no cir-

cumstance contributes more directly to the perpetuation and spread of the typhus poison, than the accumulation and bad management of contaminated clothing, etc., that ought, under all circumstances, to be purificd as soon as it leaves the patient or the bed.

Frost or low temperature, when continued a sufficient length of time, will effectually destroy both the miasma that produces yellow fever, and the paludal malaria that produces intermittent and remittent fevers; but such low temperature has no effect to arrest those fevers in the persons suffering them. It is worthy of note, that a freezing temperature does not appear to mitigate the activity of the personally infectious poisons or contagions; though, with certain exceptions, it arrests putrefaction and the catalytic or fermentative processes.

QUININE

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PROPHYLACTIC AGAINST MALARIOUS DISEASES.

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As the Commission has already recommended the use of quinine as a preventive of malarial disease, in one of its published documents, (Doc. No. 17[2], *Rules for Preserving the Health of the Soldier*, paragraph 25, issued July 13th, 1861,) it is assumed that the object of the present Report is to present a digest of the evidence upon which that recommendation was founded, with the view of procuring its timely adoption and enforcement by the authorities in immediate charge of the health of the army.

The term malarial or miasmatic disease is applied to the several forms of intermittent fever, popularly called chills or ague, of remittent fever, and, under certain restrictions, to the diseases known as continued and typhoid fevers, as they occur in malarious districts of country: to a certain extent dysentery may be also included in the list, and various modifications of other diseases, such as catarrh, rheumatism, and acute internal inflammations. In short, there

are few forms of acute disease by which healthy individuals are liable to be attacked when exposed habitually to the influence of malarial poison, which are not modified in some degree by it, and thereby brought within the remedial influence of those agents by which malarious diseases are controlled.

By far the most powerful of the remedies for this class of diseases is sulphate of quinia, or quinine, the essential or active principle of Peruvian bark; and the facts just stated explain the high value attached to this drug in the western and southern portions of our country, where diseases of malarial origin are most prevalent. Its curative properties are recognized and highly esteemed in all parts of the civilized world, and by physicians of every school. Happily, they are not confined to the cure of miasmatic diseases alone; in virtue of its tonic or strengthening power, quinine is valuable in debility arising from many other causes, promoting the appetite and power of digestion, and increasing the vital forces. Unlike many excellent medicines, it is destitute of noxious and poisonous qualities, and, unless rashly and injudiciously employed, never does serious harm; nor does it act only as a temporary stimulant, leaving a condition of greater weakness after its immediate effects have passed away, but rather, like nutritious food, confers permanently increased strength, and power of resisting disease.

These facts, however, are known and used by all

educated physicians, but there is one quality possessed by this valuable medicine which is not so generally appreciated, especially at the North, and which the Sanitary Commission desires to have recognized to the fullest possible extent for the benefit of our soldiers now in the field; and this is the power possessed by quinine, when taken regularly in small quantities, of preventing an attack of disease in a healthy person exposed to malaria.

In order to estimate fully the value of this prophylactic or preventive property of quinine, which is styled by a recent English writer "a modern discovery," it will be useful to rehearse a few well-established medical facts:—

a. Individuals undoubtedly differ in degree of susceptibility, or in their liability to be attacked by miasmatic disease, but there is no amount of natural vigor of constitution, or positive high health, which will confer immunity against the effects of the poison.

b. The young are usually more liable to the disease than those of mature age.

c. Poisoning from malaria is more liable to take place between the hours of sunset and sunrise, and in those who are fasting, fatigued, or deprived of sleep.

d. After exposure to malaria, the attack of disease is not necessarily immediate; a period of *incubation*, varying from six to twenty days, usually intervenes, and during this the individual may enjoy perfect

health. The attack, when it occurs, may assume the form of intermittent or remittent fever, or any of the other forms of miasmatic disease, varying in nature and degree of severity according to the impressibility of the individual and the virulence of the poison; or, the amount of poison imbibed may not have been sufficient to cause an explosion of purely miasmatic disease, but only enough to impress the miasmatic or paroxysmal type upon some intercurrent malady occasioned by another cause.

e. After long exposure to malaria, even though no actual attack of sickness may have occurred, a debilitated condition of health is liable to arise, characterized by a sallow complexion, diminished strength, and impoverished blood; this is known as malarial cachexia.

Now it is a well-established fact, in the experience of American physicians, that the daily use of a small quantity of quinine, say from three to six grains, in one or more doses, by those who are exposed to the danger of malarial poisoning, will in most instances prevent an attack of malarial disease, and that it will always render the disease milder, if it should occur. It will also prevent the development of malarial cachexia.*

* The medicine may be taken in its simplest form as a powder, in a pill containing one or two grains, or dissolved in water, wine, or spirits. It is generally more acceptable to the soldier in the atter form, hence the recommendation of "quinine bitters."

For those not familiar with this fact, there is ample evidence to be cited, not only in the popular and professional practice of our country, but also from foreign sources. We may refer to the well-known popularity of "bark and wine" as a "tonic" in unhealthy localities and seasons, in all parts of this country; to the practice generally adopted in our merchant service for the Isthmus of Panama, and in vessels trading with other unhealthy ports, of taking quinine daily to avert attacks of fever; and to the frequent employment of the same preventive during the last twenty years, in unhealthy localities in the West and South, by planters, for themselves, their families, their overseers, and negroes.

A communication kindly furnished by the President of the Panama Railroad Company contains facts of much weight and interest:—

"Soon after my connection with the Panama Railroad Company, in 1853, my attention was directed to the unusual amount of sickness which prevailed among the crews of vessels visiting Aspinwall. On inquiry, I could not learn that any of the crews who remained in that port for several days together were wholly exempt from attacks of fever. And it frequently occurred that a large part of them would be prostrated, especially within a few days after leaving port. This state of things induced me to investigate the whole subject, with particular reference to providing a remedy for so serious an evil. I soon became satisfied that the remedy was to be found in the regular, habitual use of quinine in moderate doses, for a few days prior to the arrival of vessels at Aspinwall, and subsequent to their departure, as well as during the time they might remain in port.

"I accordingly took especial pains to impress my views upon all parties interested, so far as I had opportunity, and when, in 1855, the Panama Company established a line of sailing vessels of its own to run between this port (New York) and Aspinwall, I consulted with one of our intelligent physicians as to the best means to be employed to secure the faithful application of the proposed remedy. Aware of the proverbial carelessness of sailors in regard to such matters, and the difficulty that might be encountered in efforts to make them take *medicine*, he recommended such a preparation of wine and quinine as, under the name of '*wine bitters*,' would not be unpalatable.

"Such preparation was immediately provided, and placed on board of every vessel of the line, with printed directions as to the manner of using it, the captains also being instructed to insist upon its use, in accordance with these instructions, by every man on board of their vessels.

"The result of this course exceeded our most sanguine expectations. From its very commencement a change for the better was seen; and during the last four years, in which seven vessels have been constantly employed in the trade, cases of sickness have rarely occurred—certainly not one case in ten, as compared with former times.

"The practice of using quinine, as above stated, is continued to the present day, and so uniformly healthy are the crews of our vessels that the subject no longer excites our solicitude.

"I would also remark that the use of quinine by the officers and employees of the company on the Isthmus has been found very beneficial; and, in connection with this, and the clearing and settlement of the adjacent country, Aspinwall has become one of the healthiest tropical ports of which I have any knowledge.

"I am, dear sir, with high respect,

"Your obed't servant,

"DAVID HOADLEY.

"Wm. H. Van Buren, M.D., etc."

The highest American authority on the *materia medica*, Prof. Geo. B. Wood, M.D., of the University of Pennsylvania, expresses his opinion on the subject in the following language:—

"Upon the same principles as those on which periodical diseases may be cured, they may also be prevented by the sulphate of quinia. There is no prophylactic measure against the miasmatic fevers at all comparable in efficiency to the use of this medicine. It seems reasonable to suppose that the same impression on the system which prevents the return of the paroxysms will prevent the occurrence of the first. Experience has established the correctness of this inference."*

From another quarter of our country we have the following evidence from a competent and reliable observer, Dr. H. W. De Saussure, of Charleston, S. C.:—

"I think that I have been able to collect a sufficient number of data to render the opinion plausible, if not conclusive, that quinine possesses the power of protecting the white man from attacks of intermittent and remittent fever, or its collaterals, when exposed for even long periods to malarious influences; and, moreover, that its daily use is in nowise injurious to health, nor does its habitual use render the system insusceptible of its remedial powers."

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* A Treatise on Therapeutics and Pharmacology, or Materia Medica, by George B. Wood, M.D., late President of the American Medical Association; Professor of Theory and Practice of Medicine in the University of Pennsylvania; Senior Physician of the Pennsylvania Hospital; one of the authors of the United States Dispensatory, etc. Philadelphia, 1861, vol. i. p. 260.

Among other cases, he relates the following in support of his views:—

"An overseer agreed to take charge of several rice plantations in one of the sickliest regions of rice culture, undertaking to spend the summer months on one of the plantations. He made no inquiry as to the health of the one chosen as his residence—it was selected from its convenient locality. When warned of the danger of his residing there in summer, he said he would never have the fever. His confidence in his capacity to resist malarious disease seemed unlimited. The result fully justified this confidence. He lived ten years or more in that neighborhood, spending every summer on the plantation, varied only by an occasional visit to the healthy pine-land, where his family resided during the summer. He visited his rice-fields without hesitation at any hour, day or night, that his business required. He never had an attack of fever during that time. I saw him after he had been there several years; a finer specimen of robust health it would have been difficult to find.

"It was ascertained, on inquiry, that it was his habit to take quinine daily, during the summer, before leaving his house; the quantity he did not know, for he never weighed it. His entire and complete confidence in his ability to resist fever in so malarious a region is strong evidence that he had been in the habit of using quinine, and was well satisfied of its prophylactic virtues. This case, in conjunction with the statements from the officers of the Niger expedition, would appear to prove that quinine may be used under exposure to malarious influences for an indefinite period, not only without compromising the general health of the individual, or injuring the constitution, but as surely protecting the system from the inroads of malarious disease."

The same writer further states:—

"I was called in August to see one of the contractors on the

Charleston and Savannah Railroad, laboring under a very severe attack of remittent fever, contracted during the superintendence of his contract between the Ashepoo and Combahee Rivers, notoriously a very unhealthy region. During his convalescence he informed me that he would have to return to his work on the road, where he had a large number of hands employed, (150;) that they were negroes brought from healthy regions in North Carolina, and he expected all of them to be more or less sick, as they were entirely unaccustomed to a malarious climate. I advised him to take quinine daily himself, and to give it to all his hands, white or black. Late in the fall I met him in the city; he looked healthy and well. He thanked me for the advice I had given him; told me he had carried up some pounds of quinine; had used it himself daily, and compelled all his employees to take it also; that he himself had never had another attack of fever; that his health was better than it had ever been, and that not a single one of the 150 hands he employed had been attacked by fever. In fact, he said: 'The only case of sickness I have had was in a negro who had come from North Carolina sick.'"*

In April, 1840, the writer, then an assistant surgeon in the United States army, was detached from the staff of the late General Worth, at Tampa Bay, Florida, for duty at a military post in the interior, (Fort King,) where a serious outbreak of miasmatic disease had just occurred. The stock of quinine on hand was limited, and the supply uncertain, and every man at the post was having his turn of disease. To meet the emergency, a quantity of quinine bitters was made in the following manner: The half of a

* American Journal of Medical Sciences, January, 1861, from Charleston Medical Journal and Review, July, 1860.

barrel of whisky was drawn off into a second barrel, and they were both filled with the bark of the dogwood* and wild-cherry, obtained from the neighboring hammock and dried in the sun. A few ounces of quinine were added to each barrel, with the dried peel of a dozen native oranges. From one to two ounces of this preparation was given to every man at the post, morning and evening, with the effect, in a very short time, of rendering the relapses of fever less frequent and milder in their character, lengthening the interval between the attacks, and in many instances preventing their occurrence entirely during its use.

It may be inferred from the above statements that the preventive use of quinine is an economical measure, saving not only the health and services of the men, but reducing also the expenditure of the medicine, for the use of a very small quantity daily will prevent an attack of disease for the cure of which a quantity much larger in the aggregate would probably be required.

Our excellent colleague, Dr. J. S. Newberry, has had large experience in the preventive employment of quinine against fevers on the Isthmus of Panama, and in various localities in the Western country, and gives his testimony strongly in favor of its use. He

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* The bark of the dogwood (*Cornus Florida*) is one of the best substitutes for Peruvian bark. The wild-cherry bark (*Prunus Virginiana*) is a well-known tonic.

is of opinion, however, that the constant use of the remedy diminishes its power, and that it is advisable to cease taking it at intervals; for example, to take it for two weeks, and then omit for one week. On this point, as we shall shortly see, the weight of evidence is rather against this opinion.

In one of the British Navy Medical Reports—No. XV., *On the Prophylactic Influence of Quinine*, by Alexander Bryson, M.D., R. N.—the following statements occur:—*

"It has long been a standing rule in the navy, enjoined by the 9th Article of the Surgeon's Instructions, that when men are to be sent on shore in tropical climates, to procure wood and water, or on other laborious duties, the surgeon, if he consider it advisable, is to recommend for each man, previously to his leaving the ship in the morning, a drachm of powdered bark, (Peruvian,) in half a gill of wine, and the like quantity of wine after the mixture; or, if there be no wine on board, one-eighth of a gill of spirits, mixed with the fourth of a gill of water, is to be used in lieu of it; and the same proportion of each is to be given to the men on their return to the ship in the evening."

As evidence of the beneficial influence of this measure, the following instances are related:—

"Twenty men and one officer were employed on shore for one day at Sierra Leone; to the former, bark, mixed with wine, was given; but the latter refused to take it. He was the only person of the whole party who was subsequently attacked with fever. Again, two boats' crews were detached from the *Hydra* to examine the River Sherbro. They remained away for a fortnight,

* Medical Times and Gazette, London, January, 1854.

and during the whole time took bark and wine as directed by the instructions, yet, though the locality is a most dangerous one, not one case of fever followed; but another boat's crew, who were absent for two days only, in the same locality and at the same time, who did not take bark, were all attacked except the officer in command of the boat."

In a report on the African station, in 1847, Dr. Bryson, feeling "the most perfect faith in the preventive influence of quinine, and trusting to its well-known antagonism to the recurrence of periodic diseases," suggested, for obvious reasons, that it should be employed as a prophylactic in the navy instead of bark, "and that its use should be continued, not only while the men were exposed in unhealthy localities, but *for at least fourteen days after they returned on board*, in order that the antagonistic influence of the medicine might be kept up until the incubative period of the disease had expired. The suggestion was adopted, and the results, upon the whole, are most satisfactory. A strong spirituous solution of *amorphous* quinine* was mixed with several pipes of wine, in the proportion of four grains of the salt to an ounce of the wine." This preparation, under the

* Amorphous quinine is obtained from the "mother-waters," after the pure quinine has crystallized. It is to be obtained from the manufacturers of quinine, and enters into the composition of several patent medicines which have a reputation for curing agues. It is much cheaper than pure quinine, and a little more than half its strength.

name of "quinine wine," was added to the medical stores of the cruisers employed on the African station, and the following extracts from the reports of the surgeons in charge of the several ships afford evidence of the effects which were observed to follow its use:—

"While coaling at Sierra Leone, writes Surgeon Sibbald, the weather was very wet, and on their several duties both men and officers were much exposed to the rain. An extra allowance of grog and quinine was given to each man, and continued afterward for a day or two to such as required it. Mr. ——, however, placed no faith in its preventive influence, and would not take it, and he alone suffered an attack of fever, which proved fatal.

"A boat's crew, belonging to the *Pluto*, were employed for twenty-five days up the Congo. The wine was regularly supplied, but it caused one of the men to vomit, and therefore he discontinued its use; he was the first to suffer from fever. Only one other case occurred among the crew.

"During our stay in the River Lagos, quinine wine was regularly offered to the men, morning and evening; all took it, I believe, except two midshipmen and two seamen belonging to the galley. These four persons subsequently each suffered a severe attack of fever. While in the whole force, consisting of upwards of 220 men, there occurred only a few other cases of trifling importance."—*Report of Mr. Heath, Surgeon of the Teazer.*

"Thirty-six men belonging to the *Water-Witch* were employed in the attack on Lagos; they were in the river four or five days, and, with the exception of three, all took quinine wine while there, and for fourteen days after they left it. Of the whole number five only were attacked with fever, namely, the three men who did not take the wine, and other two, who most imprudently exposed

themselves to the sun, and bathed while much heated by violent exercise."—*J. Henderson, Esq., M.D.*

"On the morning of the 25th of November, seventy-seven men of the ship went up the River Lagos to attack the town. Before starting, every officer and man was ordered to take a glass of quinine wine, and a sufficient quantity was put into the boats to repeat the same at night. All, to the best of my knowledge, took it, with the exception of Mr. D., master's assistant, who rather plumed himself on having escaped *taking a dose of physic.* This young gentleman, on the 10th of December, just a fortnight after, was seized with a violent attack of remittent fever; and, of the whole number who entered the river, he is the only one who, up to this date, (the 7th of January,) has been attacked."—*F. Stupart, Esq., Surgeon.*

In another of the (British) Navy Medical Reports, (No. XXX.,) *On the Endemic Fevers of Africa, and Prophylactic Use of Quinine*, by L. J. Hayne, Esq., Assistant Surgeon R. N., the following passage occurs:—*

"The following instances will tend to show the beneficial influence of quinine, as a preventive in coast fever. The boats were dispatched with thirty-two officers and men up the Rio Ponga, and remained in the river for two days and nights; one ounce of quinine wine (four grains to the ounce) was given daily to each person; between the twelfth and fourteenth day after leaving the river, four slight cases of fever occurred, which readily yielded to treatment. In another instance the boats were away up the Lagoon, at Lagos, with thirty-four officers and men, for seven or eight days; a dose of quinine was given to each *every other day only*, and seventeen of the thirty-four were afterward attacked with severe remittent fever. Again, one officer and one man

* London Medical Times and Gazette, March, 1854.

were living on shore at Sierra Leone, for eight days, awaiting the arrival of a man-of-war; neither took any quinine, and ten days after they arrived on board their ship both had remittent fever.

"It is not to be supposed that quinine will prevent the occurrence of fever in every case, but in a sufficient number to be of the utmost benefit; and the fever occurring in those cases in which it has been employed as a preventive, is sure to be of little moment."

From these quotations, which might be extended, if space permitted, it is evident that the power of quinine as a preventive of malarial disease is recognized in the British naval service; there is also abundant evidence on record of its acknowledgment by the army authorities.

In a *Report on the Topography of the Military Stations in British Guinea*, by Surgeon-Major H. C. Reade, of the army, the following recommendation occurs:*

"As a prophylactic measure, I would urge the advisability of administering quinine to the men, more particularly during the rainy seasons and the prevalence of an epidemic."

During the preparations for hostilities in China, in 1859, a series of suggestions were submitted to the consideration of the Minister of State for War, by the Director-General of the Army Medical Department, among which we find the following:—

* Statistical, Sanitary, and Medical Reports for the year 1859, (Army Medical Department,) presented to both Houses of Parliament, by command of her Majesty. London, 1861, p. 243.

"4. That a stock of quinine wine be provided, in order that a ration of it may be given to the men (at the recommendation of the principal medical officer) previous to and during the unhealthy months, or when the soldiers are required to proceed up the rivers, or on being encamped in the vicinity of marshy ground. A medical officer should be present when the quinine wine is issued, and to witness the same being drunk by the men."*

Under the new Medical Regulations for Field Service in the British army, a sanitary officer to the expeditionary army, (to China,) to be attached to the Quartermaster-General's Department, was selected and furnished with instructions for the performance of his special duties. Of these instructions, paragraphs 7 and 8 are as follows:—

"Should the force have to advance through malarious districts, or at unhealthy seasons, you will indicate the best means of mitigating or preventing attacks of disease on the march or advance.

"With reference to the above object, it will be very requisite that the men should have some refreshment, as coffee, before marching. And, from the very favorable result of its use in the China command, quinine wine is to be recommended for use during the months when fever and bowel complaints prevail, or at any epidemic seasons; and of this prophylactic each man should have a daily ration, to be taken in the presence of a responsible officer."†

As evidence of the views and opinions on the subject held by the medical officer highest in rank in the British army, and of the provisions made for the

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* Sanitary Report for 1859, *ut supra*, pp. 179, 180.

† British Army Reports for 1859, p. 181.

ample supply of the British army in the Crimea with quinine to be employed as a prophylactic, the following letter to the Inspector-General of Hospitals in the Crimea is subjoined:—*

"ARMY MEDICAL DEPARTMENT, 27th July, 1855.

"SIR:—With reference to previous letters on the subject of administering quinine, and other preparations of bark, as prophylactic remedies, I have the honor again to draw your attention to the matter.

"From all I have learned, I am persuaded that the number of cases of fever would be diminished by such a course. So convinced am I, especially by the results of the experience of naval medical officers, of the benefits arising from the prevention plan, when followed in localities in which remittent and intermittent fevers are likely to prevail, that I have taken care to provide ample supplies of quinine in anticipation of every possible demand for that article.

"Having now at command sufficient of this drug, specially provided for that service, to furnish five grains per diem to every member of a force of 35,000 men, I beg you will take such measures as you think proper, with a view to induce the medical officers to employ that remedy, in the hope that it may prove useful in warding off attacks of fever, etc.

"I have the honor to be, etc.,

(Signed) "A. SMITH, *Director-General.*

"DR. HALL, etc."

The evidence collected from the recorded experience of intelligent and reliable travelers and explorers

* Report of the Commissioners appointed to inquire into the regulations affecting the sanitary condition of the army, the organization of military hospitals, and the treatment of the sick and wounded. Presented to Parliament, etc., 1858. App. 79, p. 71.

in malarial regions, and from the British merchant service, fully confirm the facts derived from military and naval reports. The quotations appended fairly illustrate its general tenor. The remarks on African fever in the second quotation are recorded in consequence of their truth and force, and because they demonstrate its identity with the miasmatic diseases of our own country.

"Of the measures, as hygienic, most were of a general nature, the only more specific ones being the free use of quinine. The amount of sickness was very little, so that, except with the scorbutic cases, Dr. Hutchinson's really medical duties were not onerous. Of the Europeans, the most exposed to climatical influences were Mr. Hareus, Mr. Guthrie, Mr. May, and myself; Mr. Harcus was chiefly exposed during the day, and suffered only from frequent headaches from the effects of the sun's rays. Mr. Guthrie, besides undergoing daily an immense amount of fatigue, slept regularly on deck, and, nevertheless, escaped entirely. Mr. May and I went ashore whenever opportunities occurred, and as often by night as by day; we had frequently to land in swamps and other unhealthy spots, yet Mr. May had only one short and not severe febrile attack; I, in addition, always slept on deck, and was roused regularly at twelve o'clock, and at three in the morning, for the purpose of recording meteorological observations; but while in the river I had constant health. I mention these circumstances to show that, under proper precautions, Europeans may not only live quietly, but even commit with impunity what some years ago would have been considered indiscretions."—*Baikie's Exploring Voyage*, p. 328.

"It will be sufficient here to say, that African fever has nothing specific about it, that it is certainly not *sui generis*, and that it is merely an aggravated form of the disease known in this country as ague.

"The various divisions into continued, remittent, and intermittent are only calculated to puzzle and to mislead; they refer to degrees, and not to actual differences; and these forms gradually, but surely, merge into each other. In its mildest form, the fever is intermittent, that is to say, between the paroxysms intervals of health occur; more aggravated, the complaint becomes remittent, meaning, that between the febrile accessions the symptoms only remit, but do not altogether disappear; in its greatest severity the disease is *quasi*-continued, or to the unpracticed eye seems to be devoid of paroxysmal changes, but to proceed with an undeviating deadly career. But in all of these the poison, the original cause of the malady, is essentially the same; and the results depend partly on constitutional causes, partly on the amount and virulence of the poison imbibed.

"The same amount of poison will, as is the case with alcohol, affect two persons inhaling it in very different degrees. The disease is what is termed by medical men 'antiperiodic,' and the remedies required are 'antiperiodics,' of which the best known and the most efficient is quinine. This may be given as soon as the complaint shows itself; and the sooner the better, as it is the main stay of the sufferer: of course, various occasional symptoms may occur during its progress, which will require to be treated according to circumstances.

"But the great modern improvement is the discovery that quinine not only cures but that it actually *prevents;* and that by taking this invaluable drug while in unhealthy localities, persons may escape totally unscathed. The best form to use for this purpose is quinine wine, of which half a glass should be taken in the morning, and repeated, if requisite, in the afternoon.

"Experience likewise proves that if endemic fever seizes a person who has been using quinine as a prophylactic, he will escape much more easily, and have a milder and more manageable attack than another who has not been so employing it."—*Baikie's Exploring Voyage. App. G., by the Surgeon of the Expedition.*

"From the day before we crossed the bar, in the Pleiad's voyage, I commenced giving quinine solution to all the Europeans on board. Not having a sufficient quantity of the medicated wine, I dissolved the sulphate (of quinine) in like proportions in water, adding two glasses of wine to my solution. Some of the officers at first grumbled in taking it, and drank it with a very sour face; but soon all, with one exception, came to be so anxious for it, that had I not made a rule to put the bottle and glass over the engine-room, every morning at daybreak they would be down at my bedside for the dose. The man whom I could not train into taking it was one of our second mates, who in the course of our voyage had a few severe attacks of remittent fever, accompanied with delirium. * * * I think the fact which I am about to state here will answer the following paragraph in Dr. Bryson's suggestions: 'Whether or not the influence of quinine on the system, like that of other medicines, becomes lessened by long-continued use, we have no knowledge; possibly the question may be determined during the present expedition.' I had it dispensed daily for the Europeans under my charge, from the day before we crossed the bar to three weeks after our return to Fernando Po, a period of one hundred and forty days. *In no single case could I recognize its failure;* when some of our officers, who from not taking it punctually, got slight attacks of remittent fever, the accession always yielded to appropriate remedies, with doses of quinine increased to ten grains. The symptoms subdued, I returned to the original dose of quinine, observing after each occurrence the precaution to lecture them on their irregularity in taking it, pointing out its benefits, and impressing them with the fact that our return through the delta would be at the most unhealthy period of the year. Despite of these attacks, and of our prolonged stay up the river, we had the same number and the same men on our return to Fernando Po that we had on board when leaving it on the 8th of July. The preservation of their health he attributes to several

hygienic precautions, the principal of which was 'to my having induced the Europeans *to take quinine solution daily*, without making any fuss, for its palpable necessity.'"—*Impressions of Western Africa.* By T. J. Hutchinson, Esq., Her Majesty's Consul for the Bight of Biafra. Longman, 1858, p. 229.

By enforcing the systematic use of quinine, as a prophylactic, upon all the persons in their employment, the remarkable result was secured by the Messrs. Laird, which is set forth in the following letter from a member of that enterprising firm, whom the writer saw professionally during his recent visit to this country:—

"1 Leadenhall Street, London, 26th July, 1861.

"Dear Sir: Referring to my interview with you last month, and to the effects of quinine in African fever, I now inclose memoranda on that subject.* My firm of Laird, Fletcher & Co., Liverpool, are the managing agents for a line of steamers to the coast of Africa, carrying H. M. mails once a month from Liverpool, to thirteen different ports on the coast of Africa, lying between the Island of Madeira and Fernando Po. These vessels run about 10,000 miles out and home in ten weeks, and since the establishment of the line, about seven years ago, *no European has lost his life in connection with the service*, except from causes which might have produced his death in any other part of the world.

"During the past five years my late brother (Macgregor Laird) established steam communication with the interior of Africa, by

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* This memorandum contained a printed abstract of experience on the preventive use of quinine, (from which the preceding quotations were extracted,) prepared for the guidance of persons in the employ of the company.

means of the River Niger and its tributaries, making several ascents of the river during the rainy season, when its waters were high. None of the Europeans connected with these expeditions have died from fever.

"I have this month sent an exploring steamer up the same river, to return in September, and do not anticipate any loss of life. * * *

"I am, very truly yours,

"WM. LAIRD.

"DR. VAN BUREN, etc."

Sir J. Emerson Tennant (*Ceylon*, vol. i. p. 76) gives his experience as follows:—

"In traversing districts suspected of malaria, experience has dictated certain precautions, which, with ordinary prudence and firmness, serve to neutralize the risk—retiring punctually at sunset, generous diet, moderate stimulants, and the daily use of quinine both before and after exposure. These * * * * have been proved, in long journeys, to be valuable prophylactics against fever and the pestilence of the jungle.

"It is found that these alkaloids, given in certain doses, not only cure the disease, but that if administered to those exposed to the malarious exhalations, they prevent the attacks of the disease altogether."—*Encyclopedia Britannica, Art. "Intermittent Fever."*

"From the day of my arrival on the coast I took quinine morning and evening, in doses of three or four grains. This I have found a good preventive. * * * *

"During my whole stay in Africa I took, from time to time, even when in perfect health, doses of quinine wine as a prophylactic or preventive against malaria."—*Du Chaillu's Equatorial Africa*, ch. xviii. p. 369.

In conclusion, it may be fairly assumed, even from the evidence thus imperfectly and hastily collated,

that the power of quinine as a preventive of miasmatic disease is fully established as a medical fact; and that it can be employed not only with entire safety, but with the greatest advantage, even to the saving of life, by healthy persons exposed to malarial influences. Viewed in the light of humanity, as well as of economy—both of men and money—the prevention of disease is of far greater importance than its cure, and your committee venture to express the opinion that intelligent and judicious action on this important subject, at the hands of the proper authorities, would save much sickness and many valuable lives during the present campaign.

Note.—Since the foregoing memoir was written, the Medical Department of the army has had the most extensive experience relative to the prophylactic power of quinine, an experience which more than confirms what has been said by Dr. Van Buren. The sulphate of cinchonia has also been used with like results in doses of five to eight grains daily. As it is much cheaper than the sulphate of quinia, its employment is on this account more desirable. Dr. Mouat,* in his *Researches and Adventures among the Andaman Islands*, also gives the most decided testimony in regard to the value of quinine in preventing malarious fevers. He says that no man was ever permitted to land without having first taken a certain quantity of quinine in coffee, and that the effects were highly favorable.—W. A. H.

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* Annals of Military and Naval Surgery, and Tropical Medicine and Hygiene, etc. London, 1864, p. 193.

VACCINATION IN ARMIES.

VACCINATION IN ARMIES.

In view of the possible occurrence of small-pox as an epidemic in our camps, and of the well-established fact of its great contagiousness, even under the most favorable circumstances, the question of protection against its ravages commended itself, with great propriety, to the Sanitary Commission. At their request the writers have prepared a short digest of the more recent authorities upon the subject of protection, which, with the sanction of the Commission, they respectfully submit to the medical officers in the service of the Government. It is unnecessary to enter into any history of vaccination; that, it is presumed, is familiar to all to whom this paper is addressed; but the question of its protective influence and the various circumstances modifying it, together with the results of revaccination in large bodies of men, may perhaps be profitably discussed. The fact cannot be concealed that a feeling of doubt has arisen in the minds of some (chiefly non-professional persons, it is true) in regard to the efficacy and protective power of vaccination, together with an ill-defined fear

that some malign influence may through its agency be introduced into the bodies of those receiving it. To such the strongest argument that can be presented, and the unanswerable one, is that which, in the words of Jenner, "is engraved with the point of the lancet."

It may not be out of place, however, to recall the analogy, if not similarity, of the disease which prevails among several of the lower animals and in man, and its communicability and protective influence from one to the other. The "grease" in the horse and the vaccine disease or cow-pox are believed to be the same disease with small-pox in man. And as one attack of small-pox is known to be an almost certain protection against subsequent attacks, so may the artificial production of a modified small-pox in man present an immunity from further visitations. "It is well known," says Mr. A. B. Steele,* "that Jenner was strongly impressed with the conviction that cow-pox is neither more nor less than a mild form of small-pox, and this prediction has been completely verified by subsequent observations." In the report of the Vaccination Committee of the British Medical Association,† the following conclusions, drawn from the information derived from various sources, may be found.

1st. That it has been proved that cattle, in many

* Liverpool Med.-Chir. Journ., July, 1858.

† Trans., vol. viii.

ages and in different countries, have been affected with small-pox.

2d. That the disease among the inferior animals has simultaneously existed with the small-pox in man, and pursued its victims through every country of the globe.

3d. That it appeared among the cattle in England in 1745, and again in 1770, and continued its ravages up to 1800; and that the local remains of this epizootic occasionally still show themselves with considerable severity.

4th. When the disease appears among the inferior animals in a malignant form, it produces, by inoculation, a disease of a similiar severity in man.

5th. That as man has received this affection from the cow, so likewise has the cow received it from man.

6th. The direct inoculation of the cow with human small-pox has produced a mild and mitigated disease, and that such a disease, reproduced by inoculation in man, accords entirely in its character, its progress, and its protective influence, with the variola vaccinia, as described by Dr. Jenner, thus irresistibly proving his fundamental proposition, that cow-pox and small-pox are not *bona fide* dissimilar, but identical, and that the vaccine disease is not the preventive of small-pox, but small-pox itself, the virulent and contagious disease being a malignant variety.*

* Strong evidence in support of this proposition is found in the fact that cattle who were put to graze in a field where the bed-

The late Samuel Forry, M. D., of New York, formerly of the United States army, remarks:—

"That the opinion has received a very remarkable corroboration in the recent experiments of Mr. Ceely, of England, which seem to prove that not only may the cow be inoculated with variolous matter, but it may thus be converted into vaccine. Two experiments made by Dr. Thiele, of Kasan, in Russia, appear to confirm the same result. In 1836 he inoculated some cows on the udder with the matter of small-pox, which produced vesicles bearing all the characters of the true vaccine vesicle in those animals. During seventy-five successive transmissions in the human subject of the vaccine virus thus produced, it appeared always to retain its normal character. In 1838, M. Thiele repeated this experiment with the same success."*

The subject of vaccination, whether in civil or in military life, may be considered under three heads: 1. *Does vaccination afford positive protection to those exposed to the variolous contagion?* 2. *Is that protection permanent, or is it modified by any circumstances?* 3. *If not permanent, is revaccination a preventive of the disease?*

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clothes of small-pox patients were exposed to the air, contracted the disease and presented not only the characteristic eruption, but well-marked constitutional symptoms. (*Wilson on Diseases of the Skin*, 4th Am. ed., p. 453.) Dr. Waterhouse, of Cambridge, Mass., in a letter to Dr. Jenner, details the communication of the disease to cows by the hands of milkers who were suffering from variola; and Dr. Sonderland, of Bremen, communicated the small-pox contagion to cows by covering them with sheets between which persons fatally affected with small-pox had lain.

* Boylston Prize Essay.

1. *Does vaccination afford positive protection to those exposed to variolous contagion?*

In considering this first question we are struck with the vast amount of evidence which has been accumulated in its favor. It finds no parallel in any other scientific investigation. The committee have endeavored to select such only as seemed most conclusive, and have drawn largely from both domestic and foreign sources.

The late Dr. S. Forry, in the Boylston Prize Essay, 1844, says that, "as respects the protecting power of vaccination against small-pox, it is, *when perfect*, as complete a protection as any other prophylactic known to man."

The report of the committee of the Medical Society of Philadelphia, by Drs. C. J. Coxe, Condie, and C. D. Meigs, contains the remarkable fact, that during the prevalence of a most malignant and fatal small-pox in 1827, but *one* well-ascertained death from that disease, among 80,000 vaccinated, came to the knowledge of the committee.

Drs. J. Bell and J. K. Mitchell* report that of 248 cases of variola and varioloid treated at the Small-pox Hospital, 155 were unprotected, of whom 85 died; 64 were vaccinated, of whom but a single one died; 9 were inoculated, of whom 3 died; and of the 13 whose condition was unknown, none died.†

* N. A. Med. and Surg. Journ., vol. ii., 1826.

† Bell and Stokes's Practice.

In an epidemic which prevailed from 1825 to 1827, in Copenhagen, of those who had been vaccinated 428 were attacked; and in 26 of these all the symptoms of genuine variola were evinced, but only two of them died.*

In Holstein, from 1801 to 1822, 234,959 were subjected to vaccination, and only two individuals, even two years subsequent to this, had during all that time been affected with small-pox. In the kingdom of Denmark, during the same period, only one individual among 447,605 vaccinated had been attacked by modified variola.

Dr. G. B. Wood† says:—

"Vaccination affords the best attainable security to life, greater even than that accruing from a previous attack of small-pox; that, with due care, it will serve as an effectual safeguard in individual cases almost without an exception. In the course of my practice, though I have seen much of the disease, I have lost but one patient after vaccination, and in that instance death occurred, not from the violence of the varioloid disease, which was mild, but from the supervention of inflammation of the brain, consequent on the peculiar state of the patient's constitution at the time. Thus it appears that if the protection afforded by vaccination is not perfect, it is superior to any other."

Dr. John Davy, Inspector-General of Army Hospitals,‡ presents some valuable statistics in relation to the comparative mortality of the native popula-

* Forry. † Practice, vol. i. 410.

‡ Notes and Observations in the Ionian Islands and Malta, etc. Lond., 1841.

tion of Malta and the military, among whom small-pox had been introduced by H. M. S. Asia, by which it appears that the mortality among those "not vaccinated" was 1 in 4·7; among those "supposed to have been vaccinated," 1 in 23·4; among those "well vaccinated," 1 in 15·6; and lastly, among those attacked a second time by small-pox, 1 in 10·8. The higher mortality among those supposed to have been vaccinated, Dr. Davy explains by the supposition that the majority of the former may have belonged to the infantile age:—

"As regards the general effect of vaccination in its influence both as affording protection from small-pox to a considerable extent, and mitigating its severity when not preventing the attack, the facts given are clear and satisfactory. *It is a curious circumstance that the proportion of those who died after a second attack of small-pox was, as has been already pointed out, greater than in the instances of those who had the disease after vaccination.*"

The comparative exemption of the British troops serving in Malta is another evidence of the protective influence of vaccination. Dr. Davy says, further:—

"The native population (in Malta) in 1830 was estimated at 100,839 persons; among whom, it appears, from preceding returns, 1 in every 12·1 was attacked with the disease, and 1 in every 85 died; but among the military, including their wives and children, the proportion attacked was 1 in 188, and the mortality was only 1 in 682."

The petition of Mr. J. F. Marson in support of the

"Vaccination Bill,"* before the British Parliament in 1856, after declaring that he "has been for upwards of twenty years the resident surgeon of the Small-pox and Vaccination Hospital in London," states that the mortality from small-pox in the *unvaccinated*, of cases taken generally, is *thirty-five per cent.*, but of children under five years of age, it is *fifty per cent.;* and of those who recover, a great many suffer permanent disfigurement, some loss of sight, and others have their health greatly damaged.

The mortality, on the contrary, among the vaccinated, attacked by small-pox, is *seven* per cent., taken generally; but among those who may be characterized as the *badly* vaccinated, it is *fifteen per cent.* Among those, on the other hand, who may be considered to be *well* vaccinated, that is to say, who have four or more *good* vaccine cicatrices, the mortality is *less than one per cent.*

In the report of the "Small-pox and Vaccination Committee of the Epidemiological Society" of London, presented to the British Parliament in 1853, is collected a mass of evidence abundantly sustaining the protective influence of vaccination.

As *results* are most desirable in a communication like the present, the following statistics collected by the Society are presented:—

1st. To prove the influence of vaccination in England: out of every 1000 deaths in the half century

* Lancet, August 30th, 1856.

from 1750 to 1800, there were of small-pox 96. Out of every 1000 deaths in the half century from 1800 to 1850, there were of small-pox 35.

2d. To prove the influence of vaccination on the Continent: in various German States sufficient evidence can be obtained to show that, before vaccination was used, out of every 1000 deaths, there occurred from small-pox 66·5; after vaccination, 7·26.

3d. To prove that in countries where vaccination is most perfectly carried out, small-pox is least mortal:—

(*a.*) In this country, (England,) where vaccination is voluntary, and frequently neglected, the deaths from all causes being 1000, the deaths from small-pox in the following towns are as follows: London, 16; Birmingham, 16·6; Leeds, 17·5; England and Wales, 21·9; Paisley, 18; Edinburgh, 19·1, Perth, 25; Glasgow, 36; Dublin, 25·66; Galway, 35; Limerick, 41; Connaught, 60; all Ireland, 49.

(*b.*) In other countries, where vaccination is more or less compulsory, the deaths from small-pox in the following towns are as follows: Westphalia, 6; Saxony, 8·33; Rhenish provinces, 3·75; Pomerania, 5·25; Lower Austria, 6; Bohemia, 2; Lombardy, 2; Venice, 2·2; Sweden, 2·7; Bavaria, 4.

By referring to the accompanying table prepared by Mr. Haile, and found in Mr. J. Simon's report,*

* Papers relating to the History and Practice of Vaccination. Presented to both houses of Parliament by command of her Majesty. London, 1857.

the past and present ravages of the disease may be seen at a glance, and two series of facts be noticed:—

"1st. How many persons in each million of population died annually of small-pox, *before* the use of vaccination; and 2d. How many persons in each million of population have annually died of small-pox, *since* the use of vaccination."

The author draws the conclusion, as the reader may also do, between the case of Sweden, in the twenty-eight years before vaccination, and forty years soon afterward:—

"During the earlier period, there used to die of small-pox, out of each million of the Swedish population, 2050 victims annually; during the later period, out of each million of population, the small-pox deaths have annually averaged 158." "Or, compare two periods in Westphalia: during the years 1776–'80, the small-pox death-rate was 2643; during the thirty-five years, 1816–'50, it was only 114." "Or, taking two metropolitan cities: you find that, in Copenhagen, for the half century 1751–1800, the small-pox death-rate was 3128, but for the next half century only 286; and still better, in Berlin, where, for twenty-four years preceding the general use of vaccination, the small-pox death-rate had been 3422, for forty years subsequently it has been only 176. In other words, the fatality of small-pox, in Copenhagen, is but an eleventh of what it was; in Sweden, a little over a thirteenth; in Berlin, and in large parts of Austria, but a twentieth; in Westphalia, but a twenty-fifth. In the last-named instance there now die of small-pox but four persons where formerly there died a hundred."—(P. xxiii.)

By reference to the second table, it will be seen that in a number of places observed, the death-rate

varies among the vaccinated from an inappreciably small mortality to 12½ per cent.; that among the unprotected, it ranges from 14½ to 53⅘ per cent. These statistics show that the adoption of vaccination has been followed by a reduction of the small-pox mortality to a tenth and a twentieth of its former magnitude.

Approximate average annual death-rate by small-pox per million of living population.

Terms of years respecting which particulars are given.	Territory.	*Before* introduction of vaccination.	*After* introduction of vaccination.
1777–1806, and 1807–1850	Austria, Lower	2,484	340
1777–1806, and 1807–1850	Austria, Upper and Saltsburg	1,421	501
1777–1806, and 1807–1850	Styria	1,052	446
1777–1806, and 1807–1850	Illyria	518	244
1777–1806, and 1807–1850	Trieste	14,046	182
1777–1806, and 1807–1850	Tyrol and Voralberg	911	170
1777–1806, and 1807–1850	Bohemia	2,174	215
1777–1806, and 1807–1850	Moravia	5,402	255
1777–1806, and 1807–1850	Silesia (Austrian)	5,812	198
1777–1806, and 1807–1850	Gallicia	1,194	676
1787–1806, and 1807–1850	Bukownia	3,527	516
1817–1850	Dalmatia	——	86
1817–1850	Lombardy	——	87
1817–1850	Venice	——	70
1831–1850	Military Frontier	——	288
1776–1780, and 1810–1850	Prussia (Eastern Provinces)	3,321	556
1780, and 1810–1850	Prussia (Western Provinces)	2,272	356
1780, and 1816–1850	Posen	1,911	743
1776–1780, and 1810–1850	Brandenburgh	2,181	181
1776–1780, and 1816–1850	Westphalia	2,643	114
1776–1780, and 1816–1850	Rhenish Provinces	908	90
1781–1805, and 1810–1850	Berlin	3,422	176
1776–1780, and 1816–1850	Saxony (Prussian)	719	170
1780, and 1810–1850	Pomerania	1,744	130
1810–1850	Silesia (Prussian)	——	310
1774–1801, and 1810–1850	Sweden	2,050	158
1751–1800, and 1801–1850	Copenhagen	3,128	286

Death-rate per hundred cases.

Places and times of observation.	Total No. of cases observed.	Among the unprotected.	Among the vaccinated.
France, 1816–41	16,397	$13\frac{1}{8}$	1
Quebec, 1819–20	?	27	$1\frac{2}{3}$
Philadelphia, 1825	240	60	0
Canton Vaud, 1825–29	5,838	24	$2\frac{1}{6}$
Darkehmen (Durkheim's), 1828–29	134	$18\frac{4}{5}$	0
Verona, 1828–39	909	$46\frac{2}{3}$	$5\frac{2}{3}$
Milan, 1830–51	10,240	$38\frac{1}{5}$	$7\frac{2}{3}$
Breslau, 1831–33	220	$53\frac{4}{5}$	$2\frac{1}{9}$
Wirtemberg, $1831\frac{1}{2}$–$5\frac{1}{2}$	1,442	$27\frac{1}{3}$	$7\frac{1}{10}$
Carniola, 1834–35	441	$16\frac{1}{4}$	$4\frac{2}{5}$
Vienna Hospital, 1834	360	$51\frac{1}{4}$	$12\frac{1}{2}$
Carinthia, 1834–35	1,626	$14\frac{1}{2}$	$\frac{1}{2}$
Adriatic, 1835	1,102	$15\frac{1}{5}$	$2\frac{1}{5}$
Lower Austria, 1835	2,287	$25\frac{4}{5}$	$11\frac{1}{2}$
Bohemia, 1835–55	15,640	$29\frac{4}{5}$	$5\frac{1}{6}$
Gallicia, 1836	1,059	$23\frac{1}{2}$	$5\frac{1}{7}$
Dalmatia, 1836	723	$19\frac{2}{3}$	$8\frac{1}{4}$
London Small-pox Hospital, 1836–56	9,000	35	7
Vienna Hospital, 1837–56	6,213	30	5
Kiel, 1852–53	218	32	6
Wirtemberg, no date	6,258	$38\frac{9}{10}$	$3\frac{1}{2}$
Malta, no date	7,570	21·07	4·2
Epidemiological Society return, no date	4,624	19·7	2·9

In an important paper in the Transactions of the Medical and Chirurgical Society of London, (vol. xxxv.,) Dr. J. G. Balfour, Surgeon to the Royal Military Hospital, Chelsea, shows that the small-pox mortality of the British navy has not reached a third, nor that of the British army a fourth, of the London rate; and that in the experience of the Royal Military Asylum for 48 years, within which time 5774 boys have been received for training, only four deaths by small-pox occurred, *and these all in non-vaccinated* boys, who were believed already to have suffered small-pox once before becoming inmates of the school.

"And," in the words of the reviewer of the above "papers," "the combined weight of testimony from all sources of evidence is to show *that in the proportion* as vaccination *is general and efficient, so is the exclusion of small-pox from the community, and the mortality greatly lessened.*"*

From a paper on small-pox and vaccination, read before the Boston Sanitary Association, by Robert Ware, M.D., and presented to the Senate and House of Representatives of Massachusetts, we learn that in Boston, in 1721, the year in which inoculation was introduced, and when the population of Boston was only 11,000, there were 5759 cases of small-pox, of which 844 were fatal. Thus it appears that over one-half the inhabitants had the disease, and one-thirteenth died of it.

In 1730 there were 4000 cases and 200 deaths. In 1752, when the population was 15,684, the number of cases was 5545 and the deaths 539. Again, in 1764, there were 5646 cases; in 1776, 5292; and in 1792, 8346.

If we turn now to the period subsequent to the introduction of vaccination, and take the fifteen years between 1815 and 1830, when vaccination was, in a measure, compulsory, and the restrictive system of isolation in force, we find the mortality of small-pox to amount to only *fourteen* deaths. A still longer

* Brit. and For. Med.-Chir. Rev., Oct. 1857.

period, from 1811 to 1839, shows that only 52 deaths from this disease occurred.

Not only is it shown by the above statistics that the *mortality* of small-pox is diminished, but that the *frequency* of epidemics is also greatly reduced. In the report of the Epidemiological Society of London, prepared by Dr. Seaton, it is shown that during the ninety-one years (1650–1741) previous to inoculation, there had been 65 distinct and well-marked epidemics, which is a ratio of 71·4 epidemics in one hundred years.

During sixty-three years (1741–1803) in which inoculation was practiced, and that to a great extent, there were 53 distinct and well-warked epidemics, which is a ratio of 89 epidemics in one hundred years.

During the last fifty years, since vaccination has been practiced and inoculation declared illegal, there have been 12 epidemics of small-pox, which is a ratio of 24 epidemics in one hundred years.

Whence it appears that small-pox was epidemic in London before inoculation as 42; during inoculation as 54; during vaccination as 14. (*Ibid.*, p. 35.)

In concluding this branch of the subject, your committee would call your attention to the question addressed, in circular, to members of the medical profession in the United Kingdom, and elsewhere, by Mr. Simon, medical officer to the General Board of Health in London, and to the great unanimity in the affirma-

tive by the eminent authorities to whom it was sent:—

"Have you any doubt that successful vaccination confers on persons subject to its influence, a very large exemption from attacks of small-pox, and almost absolute security against death by that disease?"

Out of 512 persons to whom this question was addressed, including not only the most eminent of British and Continental practitioners, but also foreign governments, through their officials, but two dissenting answers were received; every other expressed confidence in the practice.

2. *Is the protection permanent, or is it modified by any circumstance?*

That the protective influence of vaccination is subject to modification, either from the length of time elapsed since the operation or from a greater intensity of the variolous infection overriding the protection during certain periods of life, is very generally believed. Dr. G. B. Wood* says:—

"It cannot now be denied that a single vaccination does not afford the permanent security it was supposed to do. Probably nearly one-half of those vaccinated successfully are liable to more or less effect from the variolous contagion; though it is asserted that when the operation is performed with four or more insertions instead of one, the proportion of the protection is much greater.† It is chiefly during the epidemic prevalence of variola that this disposition in vaccinated persons to be affected by the disease is

* Practice of Medicine, vol. i. p. 410.

† Medico-Chirurgical Transactions, xxxvi. 388.

observed. It has very seldom been noticed to any considerable extent at other times. Another interesting fact is, that children of eight years or under are rarely attacked, that from this time to the age of puberty cases begin to be more frequent, and that the greatest number occurs between the ages of fifteen and twenty-five. These two facts it is important to bear in mind. What can be the cause of the inefficiency of protection in certain cases? It may, the author thinks, be explained by recurrence to the facts stated above, namely, the greater tendency to varioloid during the epidemic prevalence of small-pox than at other times, and greater frequency between the ages of fifteen and twenty-five than at any other period of life. Thus the security afforded by the vaccine disease, or small-pox, occurring in seasons when no epidemic influence exists, may be effectual under similar circumstances, but may fail during an epidemic when other forces are added to that of the contagious cause. That persons are most liable to the affection between fifteen and twenty-five would seem to show that the changes which take place about the period of puberty, and continue in operation more or less until that of maturity, which may be roughly placed at twenty-five or thirty, are favorable to the development of variolous disease; and that a degree of protection, which might be sufficient either earlier or later in life, is insufficient then."

In the report, by Dr. F. W. Sargent, of cases attended in the Philadelphia City Hospital in 1845–46, it is stated that of the cases of varioloid or small-pox after one vaccination, amounting to one hundred and thirty-six, more than twice as many occurred in the ten years from nineteen to twenty-nine, inclusive, as in either of the ten years preceding or following those ages.*

* Am. Journ. Med. Sci., N. S., xvii. 372.

In a paper by A. B. Steele, Esq., M. R. C. S.,* the following passage occurs:—

"The opinion so frequently expressed, that the protection afforded by vaccination in many cases lasts for a certain period only in the life of the individual, is by no means of recent origin; for in 1809, Dr. Brown, of Musselburgh, published the opinion that the protective virtue of cow-pox diminished as the time from vaccination increased. Dr. Copland, also, in 1823, arrived at a similar conclusion, from some very remarkable cases which came under his notice; and in the present day there are many authorities of great repute in favor of this view."

Mr. Simon, in the work already quoted, states that in Paris nearly one-third of the whole deaths from small-pox occurred between the age of twenty and thirty, indicating, as he remarks, an appalling amount of post-vaccinal small-pox.

He further states that what chiefly attracted attention was, that persons who had been vaccinated ten or fifteen years ago, and who during this interval had, perhaps, repeatedly resisted small-pox, would at length, in a certain proportion of their number, yield to the infection. This had most frequently happened during the times when small-pox was severely epidemic among the unvaccinated, and when large masses of persons with vaccination of many years were exposed to the test of a strong epidemic influence. Under this ordeal, it became evident that, for some vaccinated persons the insusceptibility conferred

* Liverpool Med.-Chir. Journ., July, 1858.

by cow-pox was not of life-long duration. And from a careful analysis of cases it was shown that this lessened security of certain vaccinated persons bore at least *some* proportion to the number of years which, in each case, had elapsed since vaccination, for there were not materials to prove any uniform rate of increase from year to year, and the increase, such as it was, apparently continued up to thirty years of age, after which period it seemed that the liability to contract small-pox underwent a continuous decline. Thus, Professor Heim, taking 1055 cases of modified or unmodified small-pox in vaccinated persons, distinguished them under thirty-five heads, corresponding severally to the thirty-five years which had elapsed since vaccination. When this is divided into three successive parts, one for the *first twelve years* after vaccination, one for the next *seventeen*, and one for the *following six years*, it appears that the average number for each year is, in the first division, 12; in the second division, 48; in the third, 15. A calculation of similar materials, made by Professor Retzius,* with respect to 961 cases in the Stockholm Hospital, gave the following series to express the average allotment of small-pox to each year of life in eleven successive quinquennials, up to the age of fifty-five: $3\frac{1}{5}$, $4\frac{3}{5}$, $13\frac{1}{5}$, $45\frac{3}{5}$, $51\frac{3}{5}$, 40, 20, $17\frac{3}{5}$, $3\frac{4}{5}$, $2\frac{1}{5}$, 1.

Mr. Marson's petition, previously quoted, tends to establish the same result.†

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* Gaz. Méd. de Paris, 1843. † Blue Book, p. xxx.

"But few patients, he says, under ten years of age have been received with small-pox after vaccination. After ten years the number began to increase considerably, and the largest admitted are for the decennial period from the age of fifteen to twenty-five; and although progressively diminishing, they continue rather large up to thirty; and from thirty to thirty-five, they are nearly the same as from ten to fifteen; but, as in the unprotected, at this period of life the mortality is doubled, showing the cause to be probably as much or more depending on age and its concomitants as on other circumstances. In still further advanced life, the rate of mortality will be seen to increase also, as in the unprotected state; but this tendency may be in a considerable degree counteracted, there is but little doubt, by giving more attention than has hitherto generally been given to the perfection of the process of vaccination."

Thus it appears that age exerts a modifying influence upon the protection of vaccination, by which, during certain years of life, it is lessened. Whether it depends upon decadence of that influence, upon original imperfect vaccination, or upon a greater susceptibility, it needs not now to inquire; the fact is sufficient for our present purpose. It is not improbable, also, that in addition to the influence of age, a greater susceptibility to the variolous influence may be produced by any marked change in the habits of life of those exposed to it. Recruits and volunteers may in this manner be more *endangered* than in the pursuit of their ordinary vocations.

From what has been shown thus far, it is probably established that vaccination, if carefully performed, exerts a positive protecting influence in favor of those

receiving it. That in countries where vaccination is general, the fatality of small-pox has under its influence declined to some small fraction of that which formerly prevailed; but that there is at least a doubt as to whether that protection is operative during the period of life when men are most useful, and whether, as they approach adult life, they do not partially or wholly recover that susceptibility to small-pox which vaccination had once extinguished in them. If a doubt upon this latter point exists in the minds of those to whom the health of our troops is intrusted, surely they have a right to the benefit of that doubt, and it becomes the duty of those in authority to provide the means of safety, and restore or furnish that immunity which the soldier has either lost or failed to receive.

3. *Is Revaccination a Preventive of Small-pox?*

The answer to this question is found in the rich statistical results, mostly from foreign sources, by which so large a reduction both of the mortality and the disease itself is shown as to leave no doubt of its efficacy. Your committee have drawn largely from the reports of revaccination of large masses of men in various military establishments, especially in Germany, collected by Mr. Simon. The earliest experience of this kind came from Wirtemberg. In 1829 the practice of revaccinating the troops of that kingdom was commenced, and its collective results for the

next few years are recorded in the following table, showing an abstract of these results in relation to five years, terminating with June, 1836. The author calls attention to one great fact deducible from these observations. It is, that—

"On the average of more than 14,000 experiments, (an immense majority performed at ages between twenty and thirty years,) 34 out of every 100 persons revaccinated developed the same sort of vesicle as would arise from a first insertion of vaccine lymph. And it is important to observe that this renewed susceptibility to cow-pox did evidently not depend, so far as could be traced, on any original ineffectiveness of the former vaccination; for (as is expressly set forth in the second part of the table) among the 14,384 subjects of vaccination, there were 7845 who presented strictly normal scars of previous vaccination. Yet nearly a third of this large number gave again exactly such phenomena as arise in children when vaccinated for the first time. It does not follow from this, however, that every third man would have taken the small-pox if exposed to the contagion; but that they would have been *endangered* admits of no doubt."

	Total.	Ratio of success per 1000 cases vaccinated.		
		Perfect success.	Modified success.	No success.
Vaccination of the Wirtemberg army in the five years $1831\frac{1}{2}$–$5\frac{1}{2}$.....	14,384	340·2	260·8	411·5

13,681 of the above mentioned 14,384 military vaccinations being classified according to the marks of previous vaccination or small-pox, the results were as follows:—

Number of Cases.	Degree of success per 1000 cases of revaccination.		
	Perfect success.	Modified success.	No success.
Of 7845 cases with normal cicatrices of vaccination, the results were	310·4	280·5	409·2
Of 3545 cases with defective cicatrices of vaccination, the results were	280·7	259	460·4
Of 2025 cases with no cicatrices of vaccination or small-pox, the results were	337·3	191·1	471·6
Of 266 cases bearing marks of previous small-pox, the results were	319·5	248·1	432·3

11,565 of the same number being distributed according to age, the results were as follows:—

Age and Number.	Degree of success per 1000 cases of revaccination.		
	Perfect success.	Modified success.	No success.
Under 20 years of age there were revaccinated 124 persons, and the results were	338·7	322·6	338·7
Between 20 and 30 there were revaccinated 11,157, and the results were	285·6	259·2	455·2
Above 30 years of age there were revaccinated 284, and the results were	426·1	207·7	366·2

Inoculation of lymph (whether vaccine or variolous) is, says Mr. Simon, so to speak, a finer and more delicate test of susceptibility to the small-pox poison than is the breathing of an infected atmosphere; so that many persons, when the lymph of cow-pox or small-pox is inserted in their skin, will give, locally at least, evidences of susceptibility which

no atmospheric infection would have elicited from them. And of this perhaps there can be no more ready illustration than the fact that *persons who bore marks of previous small-pox were, in at least equal proportion with previously vaccinated persons, capable of producing perfect vaccine vesicles;* and probably they, too, if tested with variolous matter, would have shown at the inoculated part similar signs of susceptibility; whereas, notoriously, of persons who have once had small-pox, not nearly one-third becomes afterward capable of contracting small-pox by frequenting the neighborhood of the sick.

For this reason, (greatly corroborated by what had already in every-day practice been observed of the immunity of once vaccinated persons,) it was evidently impossible to argue that all who on revaccination yielded perfect vaccine vesicles would, on ordinary exposure to small-pox infection, have been infected with small-pox. Not that all, or nearly all, of them would have suffered, but that from among them more than from among other vaccinated persons the occasional sufferers by small-pox would have come.—P. 34.

In the Prussian army, in 1833, there were revaccinated between forty and fifty thousand adults, and in about 33 per cent. of the entire number this revaccination took with perfect success. In a revaccination of Russian soldiers at Kasan, the rate of perfect success was $18\frac{3}{5}$ per cent. It was observed at the same

time, that in 1436 persons presenting marks of previous small-pox, perfect vaccine vesicles would arise just as often as on persons who had once been vaccinated!

"Of nearly 20,000 revaccinations practiced in the Danish army in the four years 1843–5 and 1847, more than half were attended with perfect success, and more than a quarter with modified success.

"By the earliest of these various independent observations it was put beyond question that the same lapse of time which renders some vaccinated persons again susceptible of small-pox, renders them also susceptible of cow-pox. But it remains to be seen whether that second dose of the latter infection, which it was the object of revaccination to introduce, would restore such persons, either permanently or for a long time, to the state of security from which they had declined; whether by successful revaccination their revived susceptibility to small-pox would be extinguished."—*Ibid.*

Now this is precisely the point to which this communication tends, and it seems to be conclusively settled by the experience of the Prussian and Wirtemberg army revaccinations, which are selected from among a number of others in consequence of their extent and completeness.

"In proof of the practical value of revaccination, Mr. Simon states, on the authority of Professor Heim, that in Wirtemberg—

"During the five years, 1833–7, though small-pox infection had been sixteen times imported into different regiments of the army, there had ensued among the 14,384 revaccinated soldiers only (in the person of one whose revaccination two years before had

been followed by 'modified success') a single instance of varioloid."—P. 35.

In Prussia, just as in Wirtemberg, the practice of revaccination grew out of the knowledge that small-pox would ultimately attack a certain proportion of those who had been vaccinated only in infancy. This knowledge, too, had been dearly purchased in the Prussian army; for during the ten years preceding 1831, cases of post-vaccinal small-pox were increasing in number and fatality; attacks were counted annually by many hundreds; and within the three years 1831–3, there had occurred no fewer than 312 deaths by small-pox.

"For the last twenty years the Prussian army has represented an almost entirely revaccinated population: and what has been the contrast? 104 annual deaths by small-pox was the last experience of the former system; 2 annual deaths by small-pox has been the average for the revaccinated army. Analyzing, moreover, the 40 fatal cases of small-pox which during the last twenty years have occurred in the Prussian army, we find that only 4 of the number were of persons who (it is said) were successfully revaccinated."

"From 1843 revaccination has been compulsory in the Bavarian army; and from that date to the present time (1857) neither a single death by small-pox nor even a single case of unmodified small-pox has occurred in that population."*

"For the last twenty-one years revaccination has been general in the Danish army, and for the last thirteen years in the Danish

* Royal Ministry of War.

navy; and these two populations have almost entirely escaped contagion during several epidemics of small-pox."*

In Sweden the practice is similar, and the results equally satisfactory. In the Swedish army 1944 revaccinations were performed in 1852, of which 644, or 33·11 per cent., were successful.

In the Baden army revaccination was introduced in 1840, and has since been effected with the greatest punctuality and exactness, with the exception of the years 1848–'49–'50, when, in consequence of political events, it lapsed. The number of men attacked in twelve years by variola and varioloid before the introduction of revaccination was 169, while the corresponding number after its introduction for a like period was 52 only, of whom only 12 had been operated on with success, the remainder having been revaccinated without result, or else not at all.

Dr. T. Graham Balfour, head of the statistical branch of the medical bureau of the British army, in his first general report, presented to Parliament at its last session, has given an interesting statement of the results of the very general vaccination and revaccination in the British army during the years 1858–9. We quote the following statements and statistics from Dr. Balfour's report:—

"In 1858, in consequence of a number of cases of small-pox having occurred in the army, particularly in India, among persons

* Board of Health.

who had, to all appearance, been previously satisfactorily vaccinated, a departmental order was issued that in future every recruit should, on joining his regiment, be vaccinated, even if he should be found to have marks of small-pox or previous vaccination, and a monthly return of the results to be forwarded to the director-general.

"Under these orders, also, a number of soldiers in whom the marks of vaccination were not deemed satisfactory, were vaccinated, and the results were kept separate from those of the recruits.

"As the returns began to be furnished in October, 1858, we have included the results of the last three months of that year with those of 1859, with a view to render available all the information upon this important subject.

"The following table shows the degree of success which attended the operation in 1000 cases in each of four different categories, together with the general results upon all the men vaccinated :—

Army, exclusive of Militia.	Total No. vaccinated.	Results.	In those who bore marks of previous small-pox.	In those who bore good marks of previous vaccination.	In those who bore doubtful marks of previous vaccination.	In those who bore no marks of previous vaccination or small-pox.	Total.
Soldiers not recruits.	4,403	A perfect vaccine pustule..	414·50	423·50	294·12	488·96	413·13
		A modified ditto...	200·74	179·69	363·44	167·19	201·23
		A failure in.....	384·76	396·81	342·44	343·85	385·64
		Total.....	1000	1000	1000	1000	1000
Recruits.	21,686	A perfect vaccine pustule..	350·06	388·71	427·61	536·64	398·37
		A modified ditto...	187·09	221·16	251·93	206·06	217·33
		A failure in.....	462·85	390·13	320·46	257·30	384·30
		Total.....	1000	1000	1000	1000	1000

Embodied Militia.	Total No. vaccinated.	Results.	In those who bore marks of previous small-pox.	In those who bore good marks of previous vaccination.	In those who bore doubtful marks of previous vaccination.	In those who bore no marks of previous vaccination or small-pox.	Total.
Soldiers not recruits.	1,598	A perfect vaccine pustule..	327·07	294·57	612·12	451·85	340·06
		A modified ditto...	191·73	236·44	193·94	192·59	220·90
		A failure in.....	481·20	468·99	193·94	355·56	433·04
		Total.....	1000	1000	1000	1000	1000
Recruits.	4,823	A perfect vaccine pustule..	351·14	295·00	415·18	585·03	326·97
		A modified ditto...	212·28	248·59	174·11	105·45	230·77
		A failure in..... ..	436·58	256·41	410·71	309·52	442·26
		Total.....	1000	1000	1000	1000	1000

The following table shows the result in Wirtemberg, Bavarian, and Prussian armies, compared with the preceding:—

	Number of revaccinations.	Results in 1000 revaccinations.		
		Perfect success.	Modified success.	Failures.
Wirtemberg.....	14,384	340·2	248·3	411·5
Bavarian.....	46,023	347·3	220·6	432·0
Prussian (1836–40)..	216,426	456·3	215·0	328·7
British (recruits).....	21,686	346·1	220·9	433·0

In our own army the statistics are meager; those of Dr. Forry being the only results accessible to the committee, and these merely prove the susceptibility to revaccination. Still they are valuable as affording evidence of a "condition of danger" in those in whom

the operation was successful. The data constituting the results of Dr. Forry's paper* were furnished at Fort Wood, New York harbor, then used as a depot for recruits. Of 686 recruits vaccinated, 560 had been previously vaccinated, 74 had had small-pox naturally, and 52 had not been inoculated either with the variolous or vaccine virus, and had not had the disease naturally. Of the 560 previously vaccinated, 381 exhibited good cicatrices; in 134 they were indistinct or imperfectly developed; and in 45 no cicatrices were visible. Of the 560 previously vaccinated, 196 took the disease on revaccination, including 55 which, from the irregular progress of the vesicle, were regarded as affording a partial protection from the small-pox. Of these 196, 109 had been previously vaccinated before the age of five years; 48 between the ages of five and ten; and 39 subsequently to the latter age. To determine, then, the period during which vaccination gives a "charmed life," it is necessary to institute a comparison between these and the whole number vaccinated. Thus, of the 560 previously vaccinated, 316 took place before the age of five years; 133 between the ages of five and ten years; and 111 after the latter period. Hence it follows, though not as an exact result, that as the ages of the great majority of the men ranged from twenty to thirty-three, (the average being twenty-five

* Amer. Journ. Med. Sci., April, 1842.

years,) and as the ratio of successful revaccination is very nearly the same after each interval of age, (being about one-third,) the limit of the protective powers of cow-pox is not restricted to any precise number of years. These relative ratios among the 560 previously vaccinated, may be thus represented:—

	Under 5.	5 and under 10.	10 and upwards.	Total.
Number of vaccinations.	315	133	111	560
Number of successful revaccinations	109	48	39	196

The only statistics of revaccination of the present army we have been able to obtain are the following, kindly furnished by Dr. S. O. Vanderpoel, Surgeon-General of New York, from the first returns made to him in accordance to a general order:—

Total number of recruits examined with reference to vaccination	9548
Number of persons bearing the marks of previous vaccination	7765
Total number vaccinated or revaccinated	8095
Total number vaccinated who were found to be susceptible	2292
Number of the susceptible persons who had marks of previous vaccination	1338

This communication has shown, we trust: 1st. That primary vaccination is a positive protection, within certain limits, against small-pox. 2d. That there is a period of life when that influence declines, and that the history of epidemics teaches that small-pox will attack a variable proportion of the vaccinated if exposed to its influence. 3d. That the mere *possibility* of such a decline renders reprotection necessary. 4th. That in revaccination we have an almost infallible restorer of that protection and preventive

of the spread of variolous epidemics. Hence, that revaccination in all bodies exposed to variolous contagion is *imperatively* demanded. 5th. That the operations of vaccination and revaccination are unattended with danger to those subjected to them. The committee would therefore earnestly recommend that the Sanitary Commission make such representation to the proper authorities as will secure the revaccination of all soldiers who cannot prove its performance upon them within the previous five years, and that arrangements be made by which good vaccine virus may be distributed by their agents to the medical officers.

APPENDIX.

SIGNS OF SUCCESSFUL VACCINATION AND OF SUCCESSFUL REVACCINATION.*

(A.) "When vaccination has been successfully performed, the puncture may be felt elevated on the second or third day, and soon afterward, if examined with a magnifying glass, appears surrounded by a slight redness. On the fifth or sixth day a distinct vesicle is formed, having an elevated edge and depressed center On the eighth day it appears distended with a clear lymph. The vesicle, on this its day of greatest perfection, is circular and pearl-colored; its margin is turgid, firm, shining, and wheel-shaped. Late on the seventh or early on the eighth day

* Gregor, revised by Ceely and Marson. Second Report of the Medical Officer of the Privy Council, 1859. (Blue Book,) London.

an inflamed ring or areola begins to form around the base of the vesicle, and, with it, continues to increase during the two following days. This areola is of a circular form, and its diameter extends from one to three inches. When at its height, on the ninth or tenth day, there is often considerable hardness and swelling of the subjacent cellular membrane. On the tenth or eleventh day the areola begins to subside, leaving, as it fades, two or three concentric circles of redness. The vesicle now begins to dry in the center, and acquires there a brownish color. The lymph which remains becomes opaque, and gradually concretes; so that about the fourteenth or fifteenth day the vesicle is converted into a hard brown scab of a reddish-brown color. This scab contracts, dries, blackens, and about the twenty-first day falls off. It leaves a cicatrix, which commonly is permanent in after-life, circular, somewhat depressed, dotted or indented with minute pits, and in some instances radiated. The above-described local changes, while in active progress, are attended by feverishness: first from the fifth to the seventh day, so slightly that often the fact passes unobserved; and again more considerably during those days when the areola is about its height; the patient now being restless and hot, with more or less disturbance of stomach and bowels. About the same time, especially if the weather be hot, children of full habit not unfrequently show on the extremities, and less copiously on the trunk, a lichenous, roseolar, or vesicular eruption, which commonly continues for about a week. When vaccination is performed on such adults or adolescents as have not previously been vaccinated, and likewise when lymph is employed which has recently been derived from the cow, the resulting phenomena, as compared with the preceding description, are somewhat retarded in their course; and the areola is apt to be much more diffuse. There is also more feverishness, but eruption is less frequently seen."

(B.) "When persons who have once been efficiently vaccinated are, some years afterward, revaccinated with effective lymph,

there sometimes results vesicles, which, as regards their course and that of the attendant areola, cannot be distinguished from the perfect results of primary vaccination. But far more usually the results are more or less modified by the influence of such previous vaccination. Often no true vesicles form, but merely papular elevations surrounded by areola; and these results having attained their maximum on or before the fifth day, afterward quickly decline. Or if vesicles form, their shape is apt to vary from that of the regular vesicle, and their course to be more rapid, so that their maturity is reached on or before the sixth day, their areola decline on or before the eighth day, and their scabbing begins correspondingly early. In either case the areola tend to diffuse themselves more widely and less regularly, and with more affection of the cellular membrane than in primary vaccination; and the local changes are accompanied by much itching, often by some irritation of the axillary glands, and in some cases on the fourth or fifth day by considerable febrile disturbance."

METHOD OF PRESERVING VACCINE LYMPH.*

The following method of preserving lymph in capillary glass tubes has been found entirely successful. Lymph has been used, after being kept for several years, with satisfactory results.

The tube employed is simple, straight, cylindrical, open at both ends, and of such dimensions as to fulfill the following conditions, upon which it will be found that its peculiar value, as a means for preserving lymph for future every-day use, essentially depends. It must be—

1. In the first place, of such tenuity that it can be sealed instantaneously at the flame of a candle.

2. In the second place, large enough to contain as much lymph as is sufficient for one vaccination.

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* Dr. Husband, of Edinburgh. Second Report of the Medical Officer of the Privy Council, 1859. (Blue Book,) London.

3. In the third place, long enough to admit of both ends being sealed hermetically without subjecting the charge to the heat of the flame.

4. And, in the fourth place, of such strength as not to break easily in the mere handling.

The following is the mean of several measurements which I have made of tubes, differing somewhat in size, but all of them capable of containing a sufficient charge of lymph, and of being sealed instantaneously at the flame of a candle, without subjecting the contained charge to the heat, and also strong enough to bear all necessary manipulations without breaking:—

Average length $2\frac{3}{4}$ to 3 inches.

Diameter $\frac{1}{28}$ of an inch.

Thickness of wall $\frac{1}{190}$ of an inch.

Caliber.

The vesicles having been opened with a lancet in the usual way, the tube, held in a position more or less inclined to the horizontal, is charged by applying one end of it (the straight end, if they be not both straight) to the exuding lymph, which enters immediately by the force of capillary attraction. Allow as much to enter as will occupy from about one-seventh to one-half the length of the tube, according as its capacity is greater or less. As a general rule, each tube should not be charged with more than will suffice for one vaccination.

It is now to be sealed in one or other of the following ways:—

Either, first, make the lymph gravitate toward the middle, by holding the tube vertically and giving it a few slight shocks by striking the wrist on the arm or table; then seal the end by which the lymph entered, by applying it to the surface of the flame of a candle, or any similar flame. It melts over and is sealed immediately.

Proceed with the other end in the same way, but first plunge it suddenly, say half an inch, into the flame, and as quickly withdraw it till it touches the surface, and hold it there till it too

melts over. It is necessary to plunge it first into the flame, for this reason, that if it be at once applied to the external surface of the flame it melts over, no doubt, and is sealed; but before you have time to complete the process, and while the glass is still soft, the contained air expands with the heat, and forms a minute bulb, which either gives way on the instant, rendering it necessary for you to break off the end and commence anew, or, what is still worse, remains entire for the time, only to break afterward, in consequence of its extreme tenuity of wall, by the slightest touch. Mr. Ceely has suggested, that while this precaution is necessary for the reason stated, it serves also to expel a portion of air, and so leaves less air to be sealed up along with the fluid lymph.

Or else, secondly, the charge having entered, hold the tube with the finger and thumb, covering the inner extremity of the column of lymph and protecting it from the heat, and draw nearly the whole of the empty portion through the flame, so as to rarefy the contained air; and in withdrawing it, seal the further extremity. The column now passes quickly along toward the middle of the tube as the contained air cools, and you complete the process by sealing lastly the orifice by which it entered.

It should be observed, that in no case is a tube to be laid down until the lymph has been made to pass toward the middle of it, for the fluid concretes quickly about the orifice, and you cannot afterward detach it without difficulty; but if it be at once made to pass away from the orifice by holding the tube vertically, you may lay the charge down and take half a dozen or more in the same way before sealing them; only if you delay the sealing process too long, more than five or ten minutes perhaps, (a delay which need never happen,) the lymph within the tube is apt, from evaporation, to become adherent, especially if it be more than ordinarily viscid, and it cannot afterward be blown out when you come to use it.

If the lymph do not exude freely, the tube may require to be

drawn several times more or less obliquely across the surface of the vesicle or cluster of vesicles until a sufficient charge has entered; but generally, if the exudation be copious, and a drop of some size has formed before you begin to take your supply, the orifice of the tube need not, indeed ought not, to touch the surface, but is merely to be dipped into the clear fluid; and one may commonly in this manner, from one arm, charge five or six tubes in almost as many seconds with perfectly pure and limpid lymph, which shall contain neither epithelial scales, nor pus globules, nor blood disks, and therefore be, so far, in the best possible condition for preservation.

In order to obtain the lymph from a tube for the purpose of vaccinating, the sealed ends are broken off, and the contents blown out gently on the point of the lancet or vaccinator.

The tubes may be easily and safely sent by post in the following manner:—

A flat piece of soft fir, about three inches and a half long, an inch and a half wide, and one-sixth of an inch thick, has a narrow and shallow groove made in it about a quarter of an inch wide, into which the charged tubes, two or more of them, are placed, with perhaps a few filaments of cotton beside them to prevent motion. Another piece of wood of the same size, but which need not be quite so thick, is then laid above the groove and its contents, and the two pieces are joined in any way that is thought most convenient, by being tied or pinned together.

NEW MODE OF PRESERVING VIRUS.*

Having experienced much trouble, particularly of late, in keeping a reliable supply of vaccine virus for public vaccinations, I was glad to meet with any suggestions which would aid me in accomplishing this very desirable object. I immediately made some experiments, which have convinced me that, by the use of glycerin,

* Dr. Collins. Boston Medical and Surgical Journal, 1858.

we can probably preserve vaccine virus for a great length of time, and that when we desire it for more immediate use, this liquid is by far the best solvent for the solid matter that we possess. It saves us both time and trouble, and enables us to use the matter with much greater economy, which is of importance when our stock happens to be small. I think that no one who has once used glycerin for this purpose would desire to use anything else.

In my first experiment, I pulverized about one-eighth of an ordinary scab upon a glass plate, and moistened it with a small drop of glycerin. It is better that the matter be pulverized, as it otherwise dissolves very slowly. The quantity thus prepared served for my vaccinations for several days, amounting in all to twenty-four, among which there were about two failures—a success which I have rarely attained when using water as the solvent. There was, of course, no drying up of the matter, after the solution, requiring renewed applications of the solvent, and so long as any remained upon the plate it was ready for immediate use.

I next pulverized another one-eighth of a scab, and dissolved it in about two drops of glycerin, placed at the bottom of a very small phial. From this I filled, by suction with the mouth, four of the usual capillary glass vaccine tubes, and sealed them hermetically—using for this purpose but about one-half the two drops. From one of these tubes I have since vaccinated three children successfully, using less than one-half its contents. The other three tubes I shall keep for some time, to see if age will in any degree impair its quality.

I see no reason why, when thus dissolved in glycerin, and hermetically sealed in glass tubes, it should not retain its virtue for a great length of time. The antiseptic qualities of the glycerin, I should judge, would render it less liable to change than is the pure vaccine lymph when treated in the same way, which we know can thus be kept for many months.

If I am correct in the foregoing conclusions, which a little time will determine, the preservation of vaccine virus, and the distribu-

tion of it, when desired, to distant sections of the country, will become an exceedingly simple and easy affair. A single scab, prepared as above, would be sufficient to fill some fifty tubes, each of which would be capable of vaccinating ten or more persons.

I would suggest that the glass tubes, for this purpose, should be drawn with a little larger bore than those in use for the pure lymph, both for the convenience of filling, and that the solution may be used in a little more concentrated form than is practicable with the very fine capillary tubes, which answer well for the latter purpose.

RULES

FOR

PRESERVING THE HEALTH OF THE SOLDIER.

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The members of the Sanitary Commission ordered by the President of the United States, and acting under the direction of the Secretary of War, in co-operation with the Army Medical Bureau, to secure by all possible means the health and efficiency of our troops now in the field, and to prevent unnecessary disease and suffering, do most earnestly and affectionately request their brethren of the volunteers and militia to adopt and carry out the following "Rules for preserving the health of the soldier." They are derived from the highest authority and the largest experience of military and medical men, and it is believed that, if followed with the intelligence and honesty of purpose which characterize the American soldier, they will save the lives of thousands of brave men who would be otherwise lost to the service of their country.

They are addressed alike to officers and privates, inasmuch as the latter are liable to promotion, and

upon their officers devolves the responsibility of securing their health, safety, and comfort. They will be found in no instance to conflict with the "Army Regulations," by which all ranks are governed, and with which every good soldier should be familiar.

1. It is absolutely necessary, for the sake of humanity and the efficiency of the army, that every man laboring under any physical infirmity which is liable to unfit him for bearing without injury the fatigues and hardships of a soldier's life in the field, should be promptly discharged from the service by his commanding officer on a surgeon's certificate of disability.—*Army Regulations*, par. 159–167, and 1134, 1135, 1138.

It is the duty of every good soldier who is conscious of any such disease or defect, which may have been overlooked on inspection, to report himself to the surgeon for advice.

In case of discharge, means are provided for his prompt payment and conveyance to his home.

2. Every officer and soldier should be carefully vaccinated with fresh vaccine matter, unless already marked by small-pox; and in all cases where there is any doubt as to the success of the operation, it should be repeated at once.

"Good vaccine matter will be kept on hand by timely requisition on the Surgeon-General."—*General Regulations*, par. 1105, 1134.

3. Medical officers are earnestly advised to make

themselves familiar with the *Revised Regulations for the Medical Department of the Army*, a copy of which should be obtained by application to the Surgeon-General. They will thus learn the proper modes of securing supplies of medicines, instruments, and hospital stores, and rules for official conduct under all circumstances.

4. The articles of food composing the rations issued by the United States Commissary Department have been proved, by sound experience, to be those best calculated for the food of the soldier.

The amount allowed for each man is greater in quantity than the similar allowance for any European soldier. If he understands his duties and manages well, any commanding officer of a company or surgeon in charge of a hospital can save from 15 to 30 per cent. out of the rations furnished by Government, and, with the money thus saved, fresh vegetables, butter, milk, etc. may be procured.

5. When the surgeon considers it "necessary for the health of the troops, the commanding officer, on his recommendation, may order issues of fresh vegetables, pickled onions, sour-crout, or molasses, with an extra quantity of rice and vinegar."—*Army Regulations*, par. 1079.

Desiccated vegetables and dried apples may be obtained on similar authority.

6. When the rations furnished for the troops are damaged, or in any way unfit for use, the Army

Regulations require the commanding officer to appoint a "Board of Survey," composed of competent officers, by which they may be condemned; in which case, good provisions are issued in their stead.—Par. 926.

7. Soldiers should always eat at regular hours, as far as the exigencies of service permit. Neglect of regular hours for meals tends to disorder the digestion and to invite diarrhœa.

8. Each company should have its regularly detailed cook and assistant, who should always, on a march, be allowed to ride in one of the wagons, when practicable, inasmuch as their services are more necessary for the health of the men than in the ranks, and they are often required to cook at night the rations for the next day, while the men are sleeping. The men should always willingly procure wood and water for the cooks, whether detailed for such service or otherwise.

9. "Bread and soup are the great items of a soldier's diet in every situation: to make them well is therefore an essential part of his instruction. Those great scourges of a camp life, the scurvy and diarrhœa, more frequently result from a want of skill in cooking than from the badness of the ration, or from any other cause whatever. Officers in command, and more immediately, regimental officers, will therefore give a strict attention to this vital branch of interior economy."—Winfield Scott.

10. The best mode of cooking fresh meat is to make a stew of it, with the addition of such vegetables as can be obtained. " It may also be boiled; but roasting, broiling, or frying, in camp, are wasteful and unhealthy modes of cooking.

11. "In camp or barracks the company officers must visit the kitchen daily, and inspect the kettles. * * * The commanding officer of the post or regiment will make frequent inspections of the kitchens and messes. * * * The greatest care will be observed in washing and scouring the cooking utensils: those made of brass or copper should be lined with tin. * * * The bread must be thoroughly baked, and not eaten until it is cold. The soup must be boiled at least five hours, and the vegetables always cooked sufficiently to be perfectly soft and digestible." (*Regulations*, par. 111, 112, 113.) Medical officers should frequently examine the articles of food issued to the men, inspect and taste it when cooked, and scrutinize the goodness of the cooking, and the condition, as to safety and cleanliness, of cooking utensils.

12. Spirits should only be issued to the men after unusual exertion, fatigue, or exposure, and on the discretion of the surgeon.

Those men who drink spirits habitually, or who commit excess in its use, are the first to fail when strength and endurance are required, and they are less likely to recover from wounds and injuries.

13. Water should be always drank in moderation,

especially when the body is heated. The excessive thirst which follows violent exertion, or loss of blood, is unnatural, and is not quenched by large and repeated draughts; on the contrary, these are liable to do harm by causing bowel complaints. Experience teaches the old soldier that the less he drinks when on a march the better, and that he suffers less in the end by controlling the desire to drink, however urgent.

14. There is no more frequent source of disease, in camp life, than inattention to the calls of nature. Habitual neglect of nature's wants will certainly lead to disease and suffering. A trench should always be dug and provided with a pole, supported by uprights, at a properly-selected spot at a moderate distance from camp, as soon as the locality of the latter has been determined upon; one should be provided for the officers and another for the men. The strictest discipline in regard to the performance of these duties is absolutely essential to health, as well as to decency. Men should never be allowed to void their excrement elsewhere than in the regularly-established sinks. In a well-regulated camp the sinks are visited daily by a police party, and a layer of earth thrown in, and lime and other disinfecting agents employed to prevent them from becoming offensive and unhealthy. It is the duty of the surgeon to call the attention of the commanding officer to any neglect of this important item of camp police, and also to see

that the shambles, where the cattle are slaughtered, are not allowed to become offensive, and that all offal is promptly buried at a sufficient distance from camp, and covered by at least four feet of earth.—*Regulations,* par. 505, 513.

15. Except when impossible for military reasons, the site *of a camp* should be selected for the *dryness of its soil, its proximity to fresh water of good quality,* and *shelter from high winds.* It should be on a slight declivity, in order to facilitate drainage, and not in the vicinity of swamps or stagnant water.

A trench, at least eight inches deep, should be dug around each tent, to secure dryness, and these should lead into other and deeper main drains or gutters, by which the water will be conducted away from the tents.

16. Sleeping upon the damp ground causes dysentery and fevers. A tarpaulin or India-rubber cloth is a good protection; straw or hay is desirable, when fresh and frequently renewed; fresh hemlock, pine, or cedar boughs make a healthy bed. When occupied for any time, a flooring of planks should be secured for the tents, if possible, but this must be taken up and the earth exposed to the sun at least every week.

17. The tents for the men should be placed as far from each other as the "Regulations" and the dimensions of the camp permit, (never less than two paces;) crowding is always injurious to health. (*Regulations,*

par. 508.) No refuse, slops, or excrement should be allowed to be deposited in the trenches for drainage around the tents. Each tent should be thoroughly swept out daily, and the materials used for bedding aired and sunned, if possible; the canvas should be raised freely at its base, and it should be kept open as much as possible during the daytime, in dry weather, in order to secure ventilation, for tents are liable to become very unhealthy if not constantly and thoroughly aired.

Free ventilation should also be secured at night, by opening and raising the base of the tent to as great an extent as the weather will permit.

18. The crowding of men in tents for sleeping is highly injurious to health, and will always be prevented by a commanding officer who is anxious for the welfare of his men. Experience has proved that sleeping beneath simple sheds of canvas, or even in the open air, is less dangerous to health than overcrowding in tents.

No more than five men should ever be allowed to sleep in an ordinary army tent of the kind most commonly in use.

19. The men should sleep in their shirts and drawers, removing the shoes, stockings, and outer clothing, except when absolutely impracticable. Sleeping in the clothes is never so refreshing, and is absolutely unhealthy.

20. The men should never be allowed to sleep in

wet clothing, or under a wet blanket, if it can be possibly avoided; and, after being wetted, all articles of clothing and blankets should be thoroughly dried and sunned before being used. After a thorough wetting, there is no serious danger as long as the body is kept in motion; but the wet clothes should be replaced by dry shirt and drawers before sleeping; otherwise there is danger of taking cold, and of other grave forms of disease. If the men are deficient in the necessary supply of clothing for a change, the surgeon should report the fact to the commanding officer.

21. Camp fires should be allowed whenever admissible; they are useful for purifying the air, for preventing annoyance from insects, for drying clothing, and for security against chilliness during the night.

22. The underclothing should be washed and thoroughly dried once a week.

The men should bathe, or wash the whole body with water, at least once a week, and oftener when practicable, but the feet should be bathed daily, and the stockings washed whenever soiled.

23. The hair and beard should be closely cropped. If vermin make their appearance, apply promptly to the surgeon for means to destroy them. Extra soap may be procured on recommendation of the surgeon.

It is the immediate duty of non-commissioned officers in command of squads to see that these, and all

other precautions required for the health of the men, are strictly carried out under the orders of the company and medical officers.

24. When bowel complaints are prevalent, be especially observant of the rules for preserving health, and apply to the surgeon for a flannel bandage, to be worn constantly around the belly.

25. It is wise and prudent, when ague and fevers are prevalent, that every man should take a dose of quinine bitters at least once in twenty-four hours. This will surely serve as a safeguard against an attack of disease; it has been practiced in Florida and elsewhere with undoubted benefit.

26. The men should not be overdrilled. It is likely to beget disgust for drill, and to defeat its object. Three drills a day, of one hour each, for squads, and a proportionate length of time, when sufficiently advanced, for battalion drill, is more profitable than double the time similarly occupied. Drilling before breakfast is always injurious, especially in malarious districts.

27. When practicable, amusements, sports, and gymnastic exercises should be favored among the men; such as running, leaping, wrestling, fencing, bayonet exercise, cricket, base-ball, foot-ball, quoits, etc. etc.

28. *On a march* take especial care of the feet. Bathe them every night before sleeping, not in the morning. Select a shoe of stout, soft leather, with a broad sole and low heel.

Prefer woolen socks. If the feet begin to chafe, rub the socks with common soap where they come in contact with the sore places.

29. An old soldier drinks and eats as little as possible while marching. The recruit, on the contrary, is continually munching the contents of his haversack, and using his canteen; it is a bad habit, and causes more suffering in the end.

30. The commencement of the day's march should be prompt. Nothing tires the men so much as hanging around a camp, waiting for the word to start.

31. It is a great comfort to the men to halt for ten or fifteen minutes at the end of the first half hour; many, about this time, require to attend to the calls of nature. After this there should be a halt of ten or fifteen minutes at the end of every hour, with a rest of twenty minutes in the middle of the day for lunch. A longer halt than this stiffens the men and renders subsequent marching difficult. The best rule is to get through the day's march, and rest in camp, if possible, by two o'clock P.M.

32. The best pace to adopt in marching, is from 90 to 100 steps (of 28 inches each) to the minute; this will give a rate of from $2\frac{1}{2}$ to $2\frac{3}{4}$ miles to the hour.

In continuous marches, the leading companies should be alternated each day, as it is always less fatiguing to be in advance.

33. At the close of a day's march, every man should bathe his feet, and wash his stockings, and

get his meal before lying down to rest, removing and changing the underclothing, if wet.

34. Whenever, on a march, facilities of transportation are available, it is wise to allow the men to put their knapsacks into the wagons. This is an immense saving of strength, especially to troops unaccustomed to marching.

When there is liability to attack, and when the troops are going into battle, this measure is particularly recommended, as the men, under these circumstances, are liable to lose their knapsacks, overcoats, and blankets.

35. *In action*, the proper position in which to place a wounded or fainting man is flat upon his back, with the head *very slightly* raised.

36. The most urgent want of a wounded man is water; if a canteen or cup is not at hand, bring it in a hat or any available vessel.

37. As a rule, cuts, even when extensive, are less dangerous to life than they seem; the contrary is true of bayonet and bullet wounds.

38. Whenever blood is flowing freely from a wound by spirts or jets, there is immediate danger; and if the wound is situated in one of the limbs, a stout handkerchief or band should be promptly tied loosely around it *between the wound and the heart;* a drumstick, bayonet, ramrod, or jack-knife is to be then inserted between the skin and the bandage, and twisted around until the strangulation of the limb

stops the flow of blood, and it should be held thus until the surgeon arrives.

In a less urgent case, or where the wound is differently situated, pressure applied directly to its surface. and kept up steadily, will often save life.

39. Wounded men should always be handled with extreme care, especially if bones are broken. The medical assistants are always provided with spirits and anodynes.

40. It is by no means necessary that bullets should always be extracted; they often remain in the body, and do little or no harm—much less, in fact. than might be done in attempts to remove them.

SCURVY.

SCURVY.

Scurvy is a disease which, from whatever point it is regarded, cannot fail to attract the attention of the thoughtful military surgeon. Formerly its victims in armies and navies were to be counted by thousands annually, and if at the present time its ravages are not so extensive as a few years since, the fact that it is still not infrequently met with, shows that either we are not cognizant of all its causes, or that we ignorantly or willfully allow those circumstances to exist by which it inevitably will be induced.

The subject is one, also, which ought, in many of its connections, to receive the earnest consideration of every military commander who has the good of his troops at heart. It lies with him to carry out those hygienic measures which his medical staff may recommend, and he ought to know that the occurrence of one single case of this disease in his command shows the existence of causes which will surely give rise to it in others, and in a short time render his force miserable, inefficient, and a burden to the public it was intended to serve. Scurvy is pre-eminently a preventable disease, and its existence in an

army is *prima facie* evidence that the medical or military authorities have been neglectful of their duties.

It would be manifestly out of place in an essay of the purely practical character of this, to enter at length into the history of the disease under consideration. It would appear, however, that it was not altogether unknown to the ancients, and that it was cured, as at present, by the use of fresh vegetable food.

Modern armies and navies from the year 1260, when it attacked the army of Louis IX. in Egypt, have never been free from it the entire twelve months. During the seventeenth and eighteenth centuries, when so many naval expeditions of warfare and discovery were fitted out, whole crews were destroyed by it, and in the course of the same periods it more than decimated the armies of several European nations.

In more recent times, and notwithstanding the great advance which has been made in the knowledge of preventing and curing scurvy, it has not failed to take its victims by large numbers. Not to refer to other instances, it may be stated that our own armies have suffered greatly through its ravages. On one occasion, at Council Bluffs, in 1820, nearly the entire garrison was attacked, and many died. In Florida and in Mexico the efficiency of our forces was very materially lessened by its occurrence; and in Texas, New Mexico, and other frontier districts, cases

of it have existed every year. In 1850 and 1851 it was very prevalent in New Mexico, and was in many instances extremely severe in its character.

The numerous emigrants to the West have been attacked with scurvy to a great extent. In 1848 and 1849 several overland parties *en route* to California and Oregon were almost destroyed by it, and in 1855 and 1856 the writer witnessed many cases among the settlers in Kansas.

In the Crimea, the English and French armies were afflicted with scurvy to an extent almost inconceivable at the present day. We shall have occasion hereafter to again advert to this circumstance. Let us take care that our own large army is kept free from this scourge.

Symptoms.—The symptoms of scurvy are generally sufficiently apparent to be recognized by the careful physician. The swollen and discolored gums, bleeding upon the slightest touch; the leaden hue of the features; the peculiarly offensive breath; the appearance of patches of extravasated blood, first upon the legs, but subsequently upon other parts of the body; the hardness and permanent state of contraction of the muscles; the stiffness of the joints; the reopening of old ulcers and cicatrices; the resolution of united fractures; the general œdema of the body; the diarrhœa and dysentery, and hemorrhage from the mucous passages generally; the extreme mental depression and indisposition to any kind of

exertion, are all often met with in one individual, and then present a picture which can scarcely lead to an error in diagnosis. There are cases, however, which cannot be so readily detected, because few of the prominent symptoms above mentioned are present. In such instances the existence of scurvy can generally be inferred with certainty from the existence of peculiar circumstances, to which we shall hereafter direct attention.

The description of scurvy given by Larrey* is so graphic and truthful, that we may be pardoned for reproducing it here. Speaking of the scurvy, as it appeared in the army of Egypt, he says:—

"I have almost invariably remarked three different degrees in this scorbutic disease as in that which I had occasion to observe during my campaign in North America.

"In the first the soldier is distressed and prone to melancholy; he prefers the sitting or recumbent posture; he is not disposed to be moved by those things which ordinarily excite his mind; the approach of the enemy, the various incidents of the camp, make no impression on him; he loses his appetite, sleep is painful, and is interrupted by disagreeable dreams; the countenance becomes pale, the eyes have a melancholy expression, and are surrounded by bluish circles; the gums are painful, pale, and bleed easily on the slightest pressure; heavy pains are felt in the lumbar region and in the limbs, especially the legs; respiration is difficult and the pulse is slow and irregular; the cutaneous transpiration is arrested, and the skin becomes dry and rough,

* Memoires de Chirurgie Militaire et Campagnes, tome ii. Paris, 1812, p. 272.

like that of a plucked fowl; the bowels become constipated; the urine is secreted in small quantity, and is loaded with earthy matters; the cutaneous veins are swollen, especially those of the groin; the patient experiences a feeling of lassitude in all his limbs, and walks with great difficulty.

"Wounds quickly change their character; suppuration diminishes and becomes sanguinolent; the lips of the wound are discolored; the granulations are feeble; they are bluish, painful, and bleed on the least touch. Cicatrices assume a peculiar appearance; they become discolored, ulcerate, and are liable to mortification. The first stage indicates the loss of tone, general debility, and a diminution of the vital principle.

"In the second stage, the symptoms become more intense; the feeling of prostration augments; the pains become more violent, and are located especially in the head and kidneys; the patient falls into a state of stupor; he remains almost immovable in bed; his limbs are flexed and his whole body curved; his countenance and lips are livid; the white of the eyes changes to a leaden color; the breath becomes fetid, the gums ulcerated, and the teeth covered with black tartar. The respiration is now difficult, and is accompanied with oppression and constriction of the chest; the cellular tissue of the legs becomes engorged, especially that which is interposed between the tendo achillis and the tibia, and the swelling extends very soon to the rest of the limbs. This engorgement has more hardness than simple œdema, the impression of the finger not remaining so long as in the latter case. Pressure causes pain; black spots are perceived over the malleoli and along the course of the tibia; they also appear about the same time on the face and on the shoulders. The constipation increases; the abdomen becomes tumefied; the patient experiences a very strong feeling of heat in the præcordial region, and a dull, heavy pain about the hypochondria. The pulse is accelerated; an accession of fever occurs toward evening; wakefulness—during which state the pains are aggravated

—is very distressing to the patient. The gangrenous condition which is manifested in the wounds or cicatrices progresses. Hemorrhage becomes more frequent, the blood is black, very liquid, and coagulates with difficulty. The callus of fractures softens; the fragments become disunited and a kind of caries attacks the broken extremities, which become denuded of periosteum and sometimes enormously swollen.

"In this second stage, nature, endeavoring to conquer the obstacles which impede the exercise of the functions, redoubles her energy, and in order to re-establish the equilibrium seeks to resume the forces she has lost; but it is ordinarily in vain, and an increased degree of asthenia very soon succeeds these reactions.

"The last stage of scurvy presents a most afflicting aspect. To the febrile paroxysms and the other symptoms I have described succeeds a general depression. The swelling of the feet and legs sensibly increases, and they become covered with black spots which, by their rapid communication with each other, give a character of sphacelus to the whole member.

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"I return to the other symptoms of this stage of scurvy. The tongue is covered with a viscous and brownish-colored coating; the ulceration of the gums extends deeply toward the alveoli and interior of the mouth, attacking the veil of the palate and even the palatine arch. The teeth become loosened, and their loss is often accompanied with hemorrhage difficult to be arrested. The eyes have a dull expression, and the eyelids are swollen and puffy; a cold sweat of a nauseous odor appears over the whole body, but chiefly over the abdomen and extremities. It is this which gives so shining an appearance to the skin. The sphincters of the anus become relaxed, and diarrhœa, which often degenerates into a dysenteric and colliquative flux, becomes established. The urine is passed with difficulty on account of the paralysis of the bladder which ensues. The catheter must

then be frequently introduced or even left in the bladder permanently. The difficulty of breathing and oppression becomes extreme, and severe fits of coughing often cause the viscid mucus expectorated to be tinged with blood of a black color and fetid odor. The pulse becomes weaker, wiry, and disappears insensibly. The forces of the individual are entirely extinguished, and he has frequent attacks of syncope. The black spots, which were at first simply ecchymoses, assume the character of a true gangrene which destroys the organ it attacks. Dropsy appears, the vital functions cease, and the patient slowly but surely expires."

But, as we have already said, it is not to be supposed that scurvy is always thus clearly manifested. Cases are frequently met with in which another disease seems to be present, but which is only a symptom of the scorbutic disorder. Or the scurvy may be so overshadowed by a coexistent affection as to render its presence more a matter of inference than of actual proof. We propose to devote a short space to the consideration of these complications.

Scurvy is frequently met with associated with dysentery and typhus and typhoid fevers. We have had many examples of these combinations under our charge. Dr. Tholozan, in a paper read before the French Academy of Medicine, thus alludes to them:

"Dysentery, scorbutus, and typhus, such as we know them by classical description, consist of groups of morbid phenomena perfectly distinct from each other. When these affections are met with singly in an uncomplicated state, it is easy to recognize them, and no observer will be deceived by them. But when the diseases are mingled one with the other, or, as sometimes hap-

pens, when all three are conjoined, forming, as has been so often observed in armies, compound diseases of mixed character of special types, the pathological problem becomes complicated. Dysentery presents the characteristics of scorbutus, scorbutus is attended with delirium, as is typhus, or rather dysenteric fluxes carry off the patient, and those affected with typhus have dysentery and become scorbutic. Examples of these mixtures are not rare, for almost all serious cases are thus complicated. Such at least was my experience during the winter of 1854–55, at Constantinople."

Pincoffs* also points out the frequency with which scurvy was conjoined with other diseases during the Crimean war. He says:—

"Typhus was at that time (the winter of 1854–55) raging fiercely, and I am convinced that if not its main cause, certainly the cause of its great mortality, was the scurvy. Of twenty patients admitted during that period eighteen were usually more or less scorbutic; eight, perhaps, would be so deeply affected (as indicated by sloughing ulcers, gangrene of the mouth, general dropsy, and chronic diarrhœa) as to render recovery impossible."

He also gives it as his opinion that of the 23,587 cases of diseases of the stomach and bowels, 10,970 cases of fevers, and 2023 of frost-bites which occurred, the great majority were scorbutic.

Macleod† also refers to the fact that, among the troops serving in the Crimea, scurvy was not usually discernible by the ordinary signs, by reason of its

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* Experiences of a Civilian in Eastern Military Hospitals, etc.

† Notes on the Surgery of the War in the Crimea. London, 1858, p. 69.

being so frequently masked behind some other ailment.

In the official reports made to the British Government by the medical officers, the same facts are asserted. Thus it is said:—*

"From the details now submitted, it will be readily understood that scurvy was an affection of some importance at one period in the army. It is to be observed, however, that the returns convey but a faint conception of the disastrous part which it acted among the troops; for although it was only in comparatively rare instances that it presented itself in well-defined forms, and as an independent affection, yet the prevalence of scorbutic taint was wide-spread, and in a vast proportion of cases evident indications of it existed as a complication of other diseases, fever, and affections of the bowels. Indeed, it may be stated that, during the first six months of the siege, all morbid actions in the older residents were more or less distinctly marked by scorbutic symptoms; and the fact is constantly commented upon by medical officers. Thus, Dr. Marlow, 28th Regiment, remarks: 'Although there are apparently few cases of pure scurvy marked in the return, nearly every admission into hospital exhibited unequivocal signs of the scorbutic taint.'"

To return to the French authorities, we find that Baudens† also points out that "scorbutus prevailed under an epidemic form, and was rarely witnessed without being complicated with diarrhœa, intermittent and remittent fever, bronchitis, pneumonia, etc.

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* Medical and Surgical History of the British Army which served in Turkey and the Crimea, etc., vol. ii. p. 171.

† La Guerre de Crimée, etc. Paris, 1858, p. 219.

These complications were the most direct causes of the mortality which scurvy produced."

Scrive* states that "at the end of February more than three thousand cases of scurvy, in which the disease was well marked, existed. Some patients had only scurvy; in others it was associated with diarrhœa, dysentery, and typhus or typhoid affections, above all with frost-bites, to which it greatly increased the liability. These combinations were all-powerful; the sick were unable to resist them, and succumbed to swell the daily augmenting record of our mortality."

During the service of the writer in New Mexico and Kansas, many cases of scurvy were witnessed which were more or less marked by some more prominent affection. Diarrhœa and dysentery were frequent complications, and were often the only evidences of a scorbutic taint, except sometimes the presence of very small ecchymoses on the legs scarcely distinguishable from flea-bites. These latter were not always to be detected, and yet there could be no doubt in regard to the scorbutic character of the disease, for it always readily yielded to antiscorbutic treatment, and as obstinately resisted that directed against the obvious characteristics.

But perhaps the most common symptom of scurvy,

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* Relation Medico-Chirurgicale de la Campagne d'Orient. Paris, 1857, p. 389.

liable to lead to an erroneous diagnosis, which the writer has witnessed, was one simulating what ordinarily passes under the name of chronic rheumatism. This consisted of very severe pains in the muscles of the legs and back, increasing in severity toward evening. The appearance of the skin was not in the least altered for some time, neither was there any particular tenderness of the gums. The muscles were not permanently contracted nor abnormally hard. The progress of the disease was in many of these cases arrested at this point by appropriate treatment, but in others it passed on to well-developed scurvy. There is, we think, but little doubt that many of the cases designated in the medical reports as chronic rheumatism are in reality of a scorbutic nature. In the official work* from which we have already quoted, mention is thus made in regard to the point in question:—

"One of the most constant precursory symptoms of scurvy was an obscure form of muscular rheumatism. The individual complained of pains in his legs of an aching character, and his movements were tedious and painful; there was in these cases no articular inflammation observed, and, though the feet and legs were generally œdematous, there was little enlargement of the ankle-joints; the affection has probably been in some instances mistaken for rheumatism, and perhaps treated in the ordinary manner, but it was merely one of the signs of general cachexia,

* Medical and Surgical History of the British Army, etc., p. 175.

and advantageously treated by a return to the comforts of ordinary life."

Hemeralopia and nyctalopia, which are not infrequently met with among soldiers and sailors, are undoubtedly often due to a scorbutic taint. Dr. Coale,* U. S. navy, noticed several cases of the latter in the scurvy which occurred on board the frigate Columbia in 1838, 1839, and 1840. Dr. Foltz† witnessed several cases of both these singular affections as accompaniments to the scurvy which attacked the crew of the United States frigate Raritan in 1846.

In the Crimean war, hemeralopia, though not adverted to in the official reports from which we have already quoted, was, according to Macleod,‡ a common attendant on scurvy as it appeared among the British troops.

The writer has seen but two cases of either affection which were of undoubted scorbutic character. Both of these were hemeralopia or day-blindness, and occurred in New Mexico. The blindness was almost complete on bright, clear days. As evening approached, the patients began to see with more distinctness, and at dusk possessed nearly the natural powers of vision.

We must not forget to allude to the influence of

* American Journal of the Medical Sciences, vol. iii. p. 68.

† Ibid., vol. xv. p. 38.

‡ Op. cit., p. 71.

the scorbutic diathesis in modifying the character of wounds, in causing gangrene, in the production of bed-sores, in preventing the reunion of fractured bones, etc.; we cannot, however, do more than simply call attention to these complications.

We have pointed out, at some length, associations of scurvy with other disorders, because we are satisfied, from much observation, that a powerful cause of these diseases, the scorbutic condition of the system, is frequently overlooked, both in diagnosis and treatment. The military medical officer cannot be too circumspect in his examination of patients who are subjected to conditions favorable to the development of scurvy. He will frequently find, by careful observation, that his numerous cases of typhoid fever, diarrhœa, dysentery, rheumatism, frost-bites, etc. are in great part due to that depraved state of the blood which is the essential characteristic of scurvy, even though many prominent symptoms of the latter disease be absent; and he will find that by enforcing proper sanitary and medicinal treatment, the diseases which have resisted all his routine measures will be driven out, or, what is infinitely better, entirely prevented.

Pathology.—It would not comport with the purely practical character of this memoir to dwell to any extent upon the pathology of scurvy. In order, however, to inculcate a clear idea of the prophylaxis and treatment, it will be necessary to bring some of the

more prominent points of this portion of the subject before the reader.

We naturally look, in the first place, to the state of the blood, and we find a very decided change from the normal condition of this fluid. We shall give an abstract only of our own researches on this point.

1st. The amount of *water* is increased and the total amount of *solid matter* diminished.

2d. The *fibrin* is augmented in quantity.

3d. There is a decided diminution in the amount of *blood corpuscles.*

4th. The *albumen* is also diminished in quantity.

5th. The amount of *inorganic constituents* is very materially lessened, principally through the diminution in the quantity of *potash*, *lime*, and *iron* normally present in the blood.

These are the chief alterations which (as several analyses of the blood have enabled us to ascertain) attend the presence of scurvy.

It is scarcely reasonable to hold the opinion that any one of these alterations in the normal character of the blood is the immediate *cause* of the scorbutic diathesis. Garrod believes that a deficiency of potash in the system is the cause of scurvy. We confess to having once held a similar opinion, but more extensive observation has satisfied us of its incorrectness. The fact that under the influence of potash scurvy disappears, is no valid argument in support of the theory in question; for, as we have ascertained, iron

also effects a cure and with as much rapidity as potash. No doubt the deficiency of potash is an important point in the pathology of the disease, but it is to all the alterations in the normal constitution of the blood that we are to look for the immediate cause of the scorbutic diathesis.

We have seen that it is more than probable the immediate or essential cause of scurvy is a morbid alteration in the constitution of the blood. We come, in the next place, to consider the predisposing or exciting cause.

It was formerly held that the long-continued use of salt food was the chief cause of the development of scurvy. There was apparently just ground for this opinion, for the disease was observed chiefly among those who for long periods were subjected to this kind of diet. It is now, however, very well established that the use of salt food alone will not ordinarily excite the disease. Along with the restriction to this species of nutriment we have various other coexisting circumstances which have fully as much if not more power in giving rise to the scorbutic diathesis.

The causes of scurvy may very properly be considered under three heads: the *physical*, the *moral*, and the *dietetic*.

Physical Causes.—Darkness and *cold* are important agents in causing scurvy. Arctic voyagers have had abundant opportunity for noticing their influence.

During the arctic winter it has been uniformly the case that scurvy prevailed more extensively than during the summer, although there was no difference in the character of the food. Dr. I. I. Hayes has informed the writer that there can be no doubt on this point. Of themselves, however, they are not sufficient, for during the recent voyage of this eminent traveler and discoverer, scurvy was entirely prevented by the excellent hygienic measures he adopted, and to which we shall soon have occasion to allude.

Moisture is also a powerful cause of scurvy. This was very evident in the Crimea, where the men of the allied army were exposed in the trenches and even in their tents and huts to an excessive amount of moisture for a long period.

Impure air is another influential physical cause of scurvy. Dr. Hayes ascribes his immunity from scurvy chiefly to the excellent system of ventilation he adopted. In the United States navy it has frequently been noticed that scurvy was much more violent in those ships in which little attention was given to renewing the atmosphere, than in those where good ventilation was insisted upon. We have several times had occasion to notice the appearance of this disease among troops crowded into small barracks, while those who had plenty of room escaped, though the other conditions were the same. In New Mexico, soldiers were often packed at night in two or three tiers of beds, with two in a bed. There can be no

doubt as to the state of the atmosphere by morning, and its influence in causing scurvy was well marked.

It often happens that the physical conditions we have mentioned occur together. Dr. Opitz,* in an excellent monograph, shows that cold, humidity, and bad air were the chief if not the only causes of the epidemic of scurvy which attacked the Austrian garrison at Ranstatt in 1852. Out of 4300 men, 610 had scurvy. The unfavorable state of the atmosphere, moisture combined with cold, and the oppressive and miasmatic character of the air in the overcrowded locality of the barracks, are the causes to which Opitz mainly ascribes the epidemic.

Insufficient exercise, on the one hand, and *excessive physical exertion* on the other, are among the exciting causes of scurvy. The influence of the former has been perceived among the arctic explorers, and the over-worked soldiers of the allied army afforded marked examples of the power of the latter agent.

Moral causes.—The *moral causes* of scurvy, though perhaps not so apparent in their influence as those we have mentioned, are, nevertheless, of very considerable importance.

Nostalgia is a common exciting cause of scurvy. To this, and the *despondency of mind* which attends it, the attacks of scurvy which have proved so fatal

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* Ueber Skorbut: Vierteljahrschrift für die praktische Heilkunde, Band lxix. 1861, p. 108.

to arctic adventurers owe much of their violence. So well is *mental depression* recognized as a cause of the disease in question, that arctic navigators have taken every means in their power to guard against it.

We are convinced that many cases of scurvy occurring among overland emigrants to Oregon and California are due to despondency and anxiety. During periods of weary inaction, or the depression of mind produced by disaster and defeat, scurvy has always been more persistent and violent in armies and fleets.

Dietetic causes. — Undoubtedly the most efficient agents in the causation of scurvy are those arising from the long-continued use of food deficient in those substances which the organism requires for its perfect nutrition, or else of too unvarying a character.

For a long time it was supposed that scurvy was due to the continued ingestion of *salt meat.* It is doubtful, however, that such is the case. It is not so much the use of salt food as it is the deprivation of succulent vegetable food, which induces scurvy. Dr. Hayes has, however, recently informed the writer that he thinks the immunity of his command from scurvy was, in great part, due to the fact that the men had such an abundance of fresh reindeer meat that they did not have to resort at all to the salt provisions. There are, nevertheless, many examples on record of scurvy appearing when fresh meat has formed the staple article of diet, and we have our-

selves witnessed many cases of the disease among troops who had fresh meat four days out of the seven as a part of their ration, and who had it the other three from game which they procured for themselves. It must not be forgotten, also, that Dr. Hayes had an abundance of antiscorbutics, of which the men had an ample allowance, and that he employed every other means to prevent the disease.

The *deprivation of fresh vegetable food* is undoubtedly a powerful cause of scurvy. It is very rare that this disease makes its appearance where an abundance of such food can be obtained. It is not, however, to be inferred that scurvy does not occasionally appear among people who eat a great deal of fresh vegetable food. In such cases the moral and physical causes we have mentioned are so strong as to overcome every resistance. Dr. Pincoffs, in the work from which we have quoted, says that—

"Turks, who eat but little meat and a great deal of fruit, suffered greatly with scurvy. Dr. Leudersdoff, who had charge of a Turkish hospital during the Crimean war, had sixty of his beds filled with scorbutic cases, and the same, he says, was the case with all the hospitals, large and small, at Eupatoria. There are many examples on record of the disease appearing when fresh vegetables were supplied in abundance."

Perhaps a more influential cause than a salt-meat diet or the mere deprivation of fresh vegetable food, is found in the *sameness of diet* to which soldiers and sailors are so frequently subjected.

The following extract from a work* we have already quoted from, places the whole subject of food as a cause of scurvy in its true position:—

"It has hitherto been too constantly supposed, at least by the community in general, that scurvy is mainly, if not altogether, to be attributed to the use of salt provisions, and that it is little to be apprehended unless these form a large proportion of the daily food; but the fact is, paradoxical as it may appear, that it would be extremely difficult to prove that scurvy has any other closer connection with the use of salt than of fresh meat, for the disease is observed not alone when salt provisions constitute the food, but when the diet is composed exclusively of fresh provisions. Thus after the campaign of 1848–'49, (which terminated in the annexation of the Punjaub,) the agricultural operations of a portion of that province were for a season interrupted, and the troops, which were placed in occupation, suffered accordingly from the want of fresh vegetables. They were, nevertheless, supplied with abundance of fresh meat and bread of excellent quality, and yet, in the 24th Regiment, the annual return recorded the occurrence of several cases of scurvy. The disease also showed itself in other corps to such a degree that it was found necessary to send to a great distance, and at considerable expense, for supplies of potatoes,—the principal medical officer, pending their arrival in sufficient abundance, recommending them to be used as a salad, dressed with vinegar, in order to procure their full curative effects.

"Again, for some years after the different stations for troops were formed in the Himalaya Mountains, fresh vegetables, from the position of these stations, were not procurable in sufficient quantity, while at a subsequent date the supplies were inter-

* Medical and Surgical History of the British Army, which served in Turkey and the Crimea, etc., vol. ii. p. 179.

rupted by the breaking out of the Sutlej war; but though the soldier was provided with good fresh meat and bread, yet scurvy was not only present, but attended with its full share of mortality, both among men and women; and it became necessary to relieve corps at short intervals, after they had, in some degree, recovered from the relaxation of long-continued residence in the hot climate of the plains, and before they had too deeply acquired the scorbutic taint in the hills. In this instance the direct causes of dysentery were present—dense fogs, periodic rains, cold winds, and elevated locality; and scurvy appeared in association with dysentery; and it was here that the term scorbutic dysentery was first recognized, we believe, in a general sense, as one of proper application.

"Sir John Hall, speaking of the cause of scurvy, observes: 'Much stress has been laid on the use of salt meat in producing scurvy; my own opinion is that other agencies were in operation to induce the depression of the vital powers, and generate the cachectic condition which the men fell into. For I have seen as much scurvy at the Cape, in the campaign of 1846–'47, as occurred in the Crimea; and at the Cape no salt meat was consumed by a man in the field. Fatigue, wet, cold, and exposure, with sameness of diet,' he adds, 'will produce scurvy without salt meat. At the Cape, rice was an integral portion of the men's rations during the whole campaign; and if this article had been issued in December and January, 1854–'55, in the Crimea, the results would have been nearly the same.'

"Dr. Crawford, referring to the appearance of scurvy in the 18th Regiment during the last winter in the Crimea, offers the following remarks in illustration of the causes of scurvy, and the nature of their action:—

"'When men are placed for any length of time on a particular diet, without the opportunity of augmenting it by the addition of articles which instinct teaches them to seek out, a nice adjustment of the proportion which the various nutritious principles

should be as to each other, and to the circumstances in which the individuals so dieted are placed, is essential to health. The substitution of one class of nutritious elements for another, or the absence of a due proportion of either, will soon show itself. An instance of this sort occurred during the second Burmese war. A detachment of Europeans stationed at Meanday, were dieted for several months on fresh beef, in unlimited quantities, biscuit, with the usual allowance of rum and rice, but they were not supplied with fresh vegetables, or any substitute for them. At first the men looked robust and healthy, but after the lapse of three months, scurvy made its appearance; spongy gums, purple blotches on the extremities, hemorrhagic dysentery and profuse discharges of blood from the stomach and bowels, (during the hot stage of intermittent fevers then prevalent,) marked the outset of the disease Lime-juice was procured and issued freely, and the scurvy rapidly abated. Lime-juice or the salts rich in potass,' he continues, 'will generally check scurvy under such circumstances; and,' he adds, 'it is scarcely necessary to remark that the nitrogenous or albuminous elements were superabundant in this case.' "

The report then goes on to state:—

"As military experience has thus shown that scurvy, under certain circumstances, attends upon the use of exclusively fresh provisions, it must be conceded that salt food has no peculiar, or at least exclusive, connection with the disease; and that if the affection has more often accompanied its use, it is only because there is some co-operating agency frequently associated with the consumption of salt food which can have no place when fresh provisions constitute the diet, except under very unusual or artificial conditions of life. This agency is no other than want of variety of food—sameness in diet; and if we may consider the effect of it acting in connection with the use of fresh food, under unusual conditions of life, to be illustrated by the

facts above mentioned, its consequences under artificial conditions of life, the work of our own creation, have perhaps been abundantly testified in the history of our jails, workhouses, and, it may be also, to some extent, of our schools and factories.

"The want of variety in food constitutes the true cause of scurvy; but the diversity essential to its prevention or cure does not consist simply in the use of animal and vegetable food, but of animal food, with vegetable food of *varied properties*. We have already seen that scurvy, and its associated affections, may appear under the exclusive use of fresh meat and bread, but we are not aware that the disease has ever been observed when the diet was composed of meat and of vegetables of various kinds in due proportion."

But we are satisfied that neither the physical, the moral, nor the dietetic causes of scurvy are of themselves alone sufficient to produce the disease. It is only when all three are conjoined that scurvy makes its appearance. Perhaps the most influential cause is the want of variation in the diet, so strongly insisted upon in the foregoing extracts; but this of itself will not give rise to scurvy, otherwise we should see the Indians of our Western prairies constantly afflicted with it, and the Eskimos would never be free from the scorbutic diathesis. When we have insufficient food conjoined with mental depression and exposure to wet and cold, we have scurvy, and not otherwise.

It is extremely important not to forget this fact. It is too much the custom in the army to lay all the stress upon faulty diet, and to entirely ignore the

physical and moral causes of scurvy. The medical officer should therefore be on his guard against all these influences. He can do much to counteract their power.

Prevention of scurvy.—When we know the causes of a disease, we can do much toward preventing it. When scurvy occurs, some one is to blame; for its causes are altogether under our control. As the causes of scurvy are physical, moral, and dietetic, our measures of prevention come under the same heads.

Physical means of prevention.—First among them is the adoption of measures to secure a due allowance of pure air. This can readily be done in barracks by giving to each soldier at least six hundred cubic feet of space, and opening the window (where other means of ventilation are not provided) so as to allow of the free admission of the external air and the exit of that which has become impure. Soldiers, like civilians, have too great a horror of a draught of air, and positive orders and constant watching will be necessary to make them attend to this point.

In camp, the tents should not be placed too close together; should not be overcrowded, and should be struck every clear day, and the bedding, etc. thoroughly aired. At least once a week the tents should be moved a few feet so as to cover fresh ground.

In addition, a thorough state of police should be

kept up. In one camp which the writer has recently visited as inspecting officer, the filth which had accumulated for six weeks was shoveled into the middle of the streets so as to form high ridges, and then left to decompose. Could anything be more disgusting?

Exposure to cold and wet cannot always in a military life be avoided; much may be done, however, by warm and impervious clothing to lessen their influence.

Moderate bodily exercise should always be insisted on. It is one of the best preventives of scurvy. Armstrong* states that the men of the Investigator were required to take five hours' exercise every day. Dr. Hayes, also, always made a point of insisting on a due amount of exercise being taken by each man of his command. We believe that to this action, and the thorough means he took to provide for ventilation, are in the main to be ascribed the freedom of his party from scurvy.

Immoderate bodily exertion, when required on the part of the soldiers by military necessity, must, of course, be submitted to. But there are times when it can be avoided. A good commander will never unnecessarily fatigue his men. Drills or fatigue duty before breakfast can almost always be deprived of their bad effects by serving out hot coffee to the men.

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* Observations on Naval Hygiene and Scurvy.

Moral means of prevention.—Much may be done to induce cheerfulness in an army. Games of various kinds, especially such as require exercise in the open air, should be encouraged. Sir Edward Parry, it is said, prevented scurvy in his command by using every means in his power to cause a cheerful feeling to predominate. Books of a light character are useful agents toward this end. Theaters should likewise be encouraged. The regimental bands, however, are the most important means for conducing to cheerfulness in a command. Their usefulness in this respect cannot be overestimated, and it is to be hoped they will not be abolished. We have never seen an intelligent soldier who did not take pleasure in the music the bands afforded. Bad as it often is, it is better than none, and, if not affording the highest degree of gratification, at least amuses.

Dietetic means of prevention.—These means have always been held in high repute. When properly used they may be said to be infallible. For a great many years *lime-juice* has been regarded as the most valuable agent we possess for preventing scurvy. Since its use by the Dutch, in the early part of the sixteenth century, it has not lost in the estimation of the civilized world, and for many years has formed a component part of the ration of seamen so situated as to be liable to scurvy. In the English navy, lime-juice is issued when the men have been for fourteen days on salt meat diet. By this one article scurvy

has been almost eradicated from modern navies. Citric acid is not a substitute, it being almost entirely inert, as we have found by experience.

It can scarcely be said that pure vegetable acids are antiscorbutics. Vinegar cannot, therefore, be elevated to this rank. The lime-juice doubtless owes its valuable properties to the fact that it contains supercitrate of potassa.

We have already alluded to the efficacy of potash as an antiscorbutic. In a paper published in the American Journal of the Medical Sciences for January, 1853, we gave the results of our experience up to that time with potash in this connection. Since then we have had abundant opportunity of using it, and we have seen nothing to cause us to modify the opinion then expressed of its great value. As a prophylactic of scurvy we regard it as invaluable. At Cebolletta, in New Mexico, where the writer was stationed several years, the men of the garrison never had scurvy originating in them at that place, though it prevailed very extensively at other posts in the territory. Upon analyzing the water in use, it was found to contain a large proportion of potash, and to this fact the immunity from scurvy was attributed.

The bitartrate is perhaps the best form in which to employ potash as an antiscorbutic. It is more easily preserved and transported than lime-juice, and is, moreover, cheaper. An ounce of it taken daily when the men are so situated as to render them liable to

scurvy, would, we are confident, entirely prevent it. Dissolved as far as possible in water, with a little sugar added, it makes a very pleasant drink.

The efficacy of potash is inferentially very strongly supported by the fact that those vegetables which are most prized as antiscorbutics contain it in large quantity. Thus, besides the lime-juice, in which it exists as an acid salt, we find that *potatoes*, which are almost as efficacious, contain it in considerable proportion. In New Mexico, when the winter had passed, we found the best results were obtained from the use as a salad or greens of the *lambs' quarter*, (*chenopodium album*,) one of the first of the spring plants. The men devoured it with the greatest avidity. Upon analysis of the expressed juice, we found it to abound in potash.

The *sorrel*, (*rumex acetosella*,) which has likewise proved of the greatest value as an antiscorbutic, owes its power to the acid salt, the binoxalate of potassa, which it contains. Both these plants are found throughout the United States.

Pickles and *sour-crout* are also valuable antiscorbutics, though not to be compared with those named.

The French in the Crimea found great benefit from the use of the *dandelion*, (*leontodon taraxacum*,) which was largely gathered by the men, and which they ate with vinegar.

We might mention many other special antiscorbutics, but we think enough has been said to direct

attention to those which are most valuable. Almost any succulent vegetable will give such a variety to the ordinary diet of the soldier as to prevent the occurrence of scurvy. If our army should always get the full ration, (which is scarcely to be expected,) there would not be much probability of this disease making its appearance among our soldiers. Congress did a wise act in adding potatoes to the ration.

Treatment of scurvy.—Scarcely anything remains to be said under this head. The general treatment is that which we have indicated as best adapted to prevent the occurrence of scurvy. The special treatment must be directed to such prominent symptoms as particularly claim attention. The measures to be adopted are, however, at most merely adjuvants to those physical, moral, and dietetic means which we have already insisted upon, and which will of themselves eventually relieve any local manifestations of the disease. Swollen and spongy gums may, however, be washed with a solution of tannin or a dilute solution of persulphate of iron. Ulcers are to be treated according to the general principles applicable; weak astringent or gently stimulating applications being generally the best.

Stiff joints are to be rubbed with a stimulating liniment and subjected frequently to passive motion. Should false anchylosis have occurred, the limb is to be forcibly extended and fixed by mechanical means.

We have frequently succeeded in restoring complete motion under such circumstances by this measure.

A tonic course of treatment has been recommended in scurvy. We scarcely think it frequently necessary. *Iron*, however, is always beneficial, and deserves to rank high as a remedy for this disease. We have had no experience with it as a prophylactic, but as an antidote to the scorbutic diathesis it is very valuable. We have usually preferred the tincture of the chloride in doses of thirty drops three times a day. The beneficial effect soon becomes well marked.

Bathing frequently is also a valuable adjuvant. The bath should be tepid, so as neither to exhaust nor depress the vital powers.

In conclusion, we have only to repeat, what we have already said, that scurvy is a pre-eminently preventable disease. A case of scurvy in a camp or garrison is a reproach to some one. Let the members of our profession who are charged with the medical care of our sick soldiers see to it that the odium does not rest with them.

MIASMATIC FEVERS.

MIASMATIC FEVERS.

Diseases of malarious origin, especially febrile affections due to this source, are of such importance to the army surgeon that the United States Sanitary Commission have judged it proper to devote a few pages to their consideration.

Of the intimate nature of the "paludal poison," "marsh miasmata," or "malaria," we are in complete ignorance. Of the hypotheses thus far advanced, the most plausible are those which refer the morbific influence to the sporules of cryptogamic plants, or to the infinitesimal ova of infusoria. Nevertheless, these are mere theories, unsupported by demonstration addressed to the eye, through the medium of the most perfect microscopes; nor have partisans of the atmospheric or gaseous hypothesis been more successful in attempting to show, by eudiometry, the existence of any peculiar matter in the air of infected places.

This confession of ignorance still leaves us in possession of certain knowledge concerning malaria, from which much practical good may be derived.

1st. It affects, by preference, low and moist localities.

2d. It is almost never developed at a lower temperature than 60° Fahrenheit.

3d. Its evolution or active agency is checked by a temperature of 32°.

4th. It is most abundant and most virulent as we approach the equator and the sea-coast.

5th. It has an affinity for dense foliage, which has the power of accumulating it, when lying in the course of winds blowing from malarious localities.

6th. Forests, or even woods, have the power of obstructing and preventing its transmission, under these circumstances.

7th. By atmospheric currents it is capable of being transported to considerable distances—probably as far as five miles.

8th. It may be developed, in previously healthy places, by turning up the soil; as in making excavations for foundations of houses, tracks for railroads, and beds for canals.

9th. In certain cases it seems to be attracted and absorbed by bodies of water lying in the course of such winds as waft it from the miasmatic source.

10th. Experience alone can enable us to decide as to the presence or absence of malaria, in any given locality.

11th. In proportion as countries, previously malarious, are cleared up and thickly settled, periodical

fevers disappear—in many instances to be replaced by the typhoid or typhus.

12th. We possess, in our materia medica, an antidote to the malarious poison, as well as a prophylactic against it.

13th. The propinquity of large fires will often prevent the injurious effects of malaria.

Inasmuch as the fevers due to miasmatic influence are identical in nature, it has been thought well to give brief descriptions of the different varieties, reserving the treatment for subsequent consideration, when the special therapeutics of each will be mentioned.

These varieties, mutually convertible one into the other, are known as the *intermittent*, the *remittent*, and a third, partaking generally of the first, but occasionally of the second, and best known in the United States as the *congestive*.

Of the intermittent fevers, known in this country as "ague," "fever and ague," "chills and fever,"—characterized by an entire cessation of febrile phenomena, during a certain time,—we have several types:—

1st. The *quotidian*, occurring once in every twenty-four hours, and commencing about the same time of day.

2d. The *tertian*, occurring once every other day, with a tendency to observe the same rule with regard to time of commencement.

3d. The *double tertian*, in which there is a morn-

ing paroxysm on one day, and an evening paroxysm on the day following—the alternate days exhibiting, in general, fevers of similar characters.

4th. The *quartan*, occurring every third day, at or about the same hour.

5th. Other irregular types, as the quintan, sextan, heptan, etc., are to be looked upon as medical curiosities—so rarely are they met with. The frequency of occurrence of these types is in the order named above.

An attack of intermittent fever may have prodromata common to the other varieties, or it may be sudden. When these prodromata occur, they are usually found to consist of furred tongue, loss of appetite, headache or other neuralgic pains, or that well understood condition of *malaise*, in which the patient may only complain of "not feeling well."

When the disease is well developed, we recognize

The cold stage, ushered in generally by a chill, sometimes amounting to a mere sense of coolness—sometimes to a violent rigor. The features are shrunken and anxious; the skin cold to the touch, and shriveled; the nose, ears, lips, fingers, and toes are bluish. The patients instinctively seek the warmest spot attainable. The breathing is oppressed, sighing or yawning. To the thermometer the skin may show a diminished temperature, or may be normal in this respect, even while the patient complains of feeling cold.

Anorexia, and nausea or vomiting are often present. Usually the bowels are constipated, the urine is abundant and limpid.

Pains in the limbs, head, and back are frequent. The pulse is commonly quickened and small.

The cold stage may last for a few minutes or for several hours. As it subsides, the sense of chilliness ceases to be felt, the patient throws off the clothes, thirst becomes urgent, the pulse increases in frequency and force, while the quickened respiration is normal in rhythm. The headache becomes more severe, as do the other neuralgic pains; the tongue is furred; anorexia continues, — so may nausea and vomiting, with constipation of the bowels.

The thermometer shows an increased heat of the body, above the normal standard. The secretions are diminished, including that of the urine, which is high colored, and frequently yields deposits of urates, on cooling. In many individuals, delirium is a striking symptom. In others, a strong disposition to sopor or coma is observed.

After a variable duration, the febrile symptoms described diminish in intensity, and finally disappear—sometimes suddenly, at others gradually, the body becoming cooler, and covered with a more or less copious perspiration. It is through this third or *sweating stage* that the *intermission* is reached. During this, the patient may complain severely or malaise and debility, or he may be altogether unconscious of any ailment.

Many variations from the description above given may be met with. There may be no perceptible chill, the paroxysm seeming to commence with the hot stage. There may be no fever, and no sweating, the chilly sensations only being those recognized; or, lastly, there may be a periodical sweat, without chill or fever. Indeed, any well-marked periodical pathological phenomena, not known as hectic, occurring in malarious regions, are by some practically regarded as belonging to the disease under description; since the same agency gives rise to them, and to the same remedy must we look for cure.

The period elapsing between the termination of a paroxysm and the commencement of that which succeeds, is called the *intermission.*

The diagnosis of this disease, consideration being given to the place and circumstances in which it occurs, is not generally attended with difficulty, after observation of one paroxysm.

With reference to the etiology, there are several points of interest.

1st. The disease is very little apt to commence at night.

2d. From the middle of summer to the beginning of winter is the season during which it is most prevalent in the United States.

3d. It is not possible to predict the amount of malarious fever that will ensue from any given conditions of heat, moisture, atmospheric or telluric phenomena.

4th. In the more temperate regions, the intermittent type predominates. As we approach the equator, there is more tendency in the fever to become remittent or congestive.

5th. From Forry's tables, we infer that the relative prevalence of the disease, in different sections of the United States, is as follows, viz.:—

On the Northern lakes, 193.

Posts north of 39° north latitude, at a distance from the sea and great lakes, 151.

Sea-coast stations from Delaware capes to Savannah, 370.

In the Southwest, including Jefferson Barracks, Forts Gibson, Smith, Coffee, Towson, and Jesup, 747.

On the Lower Mississippi, 385.

In East Florida, 520.

6th. It is an incontestable fact that negroes are more exempt than whites from all miasmatic ailments. It is believed that in mulattoes, the ability to suffer is regulated by the amount of Caucasian blood in the individual concerned.*

7th. The poison of fever may remain in the system very various times after exposure to malaria. In some instances, a few days only will elapse before the disease declares itself; in others, an interval of

* The negro troops employed during the present rebellion have suffered far less than the whites from malarious diseases.—W. A. H.

four or five months—perhaps longer—may pass over before the manifestation of symptoms.

8th. There is a certain protective power against the influence in question, by what is known as *seasoning* or *acclimation:* in other words, by previous residence in the infected locality.

9th. Among exciting causes, we recognize exposure to the outdoor air between sunset and sunrise; long-continued exposure to direct insolation, at high temperature; exposure to cold, while the body is warm and the skin active; fatigue; excessive indulgence of any kind, especially in intoxicating beverages.

10th. Of all diseases known, intermittent fever is, more than any other, apt to be characterized by a tendency to repeat itself many times in the same subject. After having been once cured, there is a powerful disposition to recur on the seventh day, or on some day represented by a multiple of seven—dating from the last paroxysm.

11th. The disease has a natural tendency, when undisturbed by treatment, to terminate at very uncertain periods—sometimes lasting only a week, at others, four or five months.

All kinds of malarious fever have a tendency, when long continued, to produce certain lesions of innervation and visceral disease, especially of the liver and spleen, and to interfere with the function of hæmatosis. From derangements of the latter, with the accompanying debility and hydræmia, it is

not uncommon to find dropsical affections of the lower extremities. In the experience of New York hospitals, the worst forms of this malarious cachexia have been found in convalescents from what is known as Panama fever. In those, it was very common to find obstinate diarrhœa or dysentery as complications.

In simple intermittent fever, we can always make a favorable prognosis. In many instances, remittent fever is tractable and unattended by danger to life, while certain epidemics may show a very large percentage of fatal cases.

The congestive is the most to be dreaded, the mortality being, nearly always, very large. "Without treatment, or with the usual treatment of bilious fever, which is little better than none, in this disease, probably three-fourths of the cases terminated fatally. But with a special treatment, not more than one in eight." (*Parry.*) In Maillot's cases, the mortality was 393 out of 1211, a little less than one in three.

Before proceeding to speak of the therapeutics of miasmatic fever, it may, for the sake of brevity, be well to glance at the differences between the intermittent and the two other types mentioned. In the remittent form,* the difference may not, and

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* *Synonyms.*—Bilious Fever, Bilious Remittent, Lake Fever, Country Fever, Walcheren and African Fevers.

probably would not be recognized by the physician, until the time should have arrived for the occurrence of the sweating stage. This may appear imperfectly or copiously; but instead of the relief which the patient should experience during the intermission, there is only a *diminution* of the unpleasant symptoms. The pulse continues to beat rapidly, the headache and other neuralgic pains remain—usually with diminished intensity—the thirst, anorexia, and malaise are still complained of; and in the course of a short time, the phenomena of the hot stage are reproduced, sometimes with, sometimes without the preceding chill. Once or twice in the twenty-four hours —morning and evening—there occurs this temporary amelioration of symptoms, (*remission,*) followed by a reappearance of the febrile phenomena, (*exacerbations.*) The type may be quotidian, tertian, or double tertian—more frequently the first or third than the second. In some cases, so slight is the remission that the form may be regarded as *continued.*

Should there be chills ushering in the exacerbations, the former are apt to be less marked, at the end of each remission, until they finally disappear.

From the long-continued congestion of the stomach, probably, there is more apt to be severe nausea, vomiting, or epigastric pain and tenderness, than in intermittent fever. We may say the same of all the symptoms which have been described as belonging to the exacerbation.

Remittent fever may terminate spontaneously, in the course of two weeks, or it may last for thirty or forty days. On an average, we may expect convalescence at the end of a fortnight, under favorable circumstances. With appropriate treatment, its duration is much abridged.

The rapidity and completeness of convalescence are inversely proportional to the danger of the disease. Relapses are easily induced by exposure to any of the exciting causes. Over-indulgence of the appetite for food is especially to be avoided.

Little need be said in addition to what has already been remarked concerning the pathological anatomy of the disease. The bronzed liver, owing its color, as has been shown by Professor Alonzo Clark, to the existence of hæmatoidin diffused through the organ, and not to hemorrhage into its substance, is the most uniform and characteristic phenomenon to be met with on post-mortem inspection. It is worthy of remark that this condition of the liver may exist for several years after recovery from the fever, and that it may occur from long residence in a miasmatic region, the patient never having suffered from remittent fever.

Another lesion, nearly always present, consists in the enlarged, softened, bluish-black spleen. This has been known to reach the enormous weight of eleven pounds. It is doubtless the result of chronic hyperæmia, as are most of the morbid appearances described

by authors, met with in the brain and mucous membranes.

It has been said that congestive fever is the form most dreaded by patient and practitioner. This has been called *algid fever, pernicious or malignant intermittent, pernicious remittent.* We shall preserve the name, sanctioned by long usage, by which it is known among American physicians.

In remittent fever, the tendency seems to a perpetuation of the hot stage; in the congestive, to a perpetuation of the cold.

Ordinarily, as has before been stated, it does not show itself as such, *ab initio.* We are able to recognize its existence, from observing that in the course of a common intermittent paroxysm, the first stage, after lasting longer than usual, is not followed by the typical febrile symptoms. The face and extremities become pale or livid, the countenance is expressive of anxiety which the patient does not feel, or it wears a shrunken and impassive look. The skin, covered with a cold, clammy sweat, often resembles that with which we are familiar in Asiatic cholera, known as the "washerwoman's." Increased heat may be perceptible to the hand, over the chest and belly, while the extremities are very cold.

Complaint is made of epigastric tenderness and oppression. The stomach is often so irritable as to eject even small quantities of ice-water, or of any fluid that may be swallowed. The matters vomited

rarely contain bile. They are usually composed of the fluids administered, or of thin mucus, frequently mixed with blood. The thirst is one of the most striking symptoms. Dr. Parry mentions some of his patients exclaiming, "Oh, that I could lie in the river! Oh, if I could have a stream of cold water to flow through me!" and this, too, with the algid skin, the cold tongue, and the cool breath.

The bowels, sometimes quiet, are usually loose, the dejections, after the first few, becoming copious and not unlike those of cholera, mixed with blood. When the alvine dejections continue bilious, the prognosis is favorable.

Dyspnœa is almost always a prominent symptom. The respiration may be hurried, irregular, panting, or it may be performed by a succession of long-drawn sighs. With this difficulty of breathing is associated, as the rule, a small, weak, and frequent pulse.

A constant sense of restlessness, uneasiness, or jactitation indicates the state of innervation. Oftentimes the patient, when nearly moribund, will insist on getting up from the bed and walking about the room. As in cholera, there is marked apathy as to the course and result of the disease. Cramps in the extremities are frequently observed. In some cases of congestive fever, the above-mentioned symptoms may continue, without any change, except in augmented intensity, when the patient is apt to die, either by coma, by syncope, or by asthenia, within

seventy-two hours of the initial chill. When the progress is more favorable, a certain amount of febrile reaction occurs, very disproportionate in amount to the chill. The body generally becomes warmer, and a sort of intermission results. Discomfort and epigastric uneasiness are, however, very prone to remain. On the day following, or on the second day, there may be a repetition of these phenomena,—in cases terminating favorably and spontaneously,—the algid phenomena becoming less marked, and the pyrexia more developed, until the paroxysms assume the character of ordinary intermittent.

Unfortunately, this is not the usual history. With each accession of congestive chill, the lesions of innervation and the consequences of local hyperæmia become more serious, until the third paroxysm, beyond which life is not apt to be protracted, if the disease have been allowed to run an unobstructed course.

Inasmuch as the disease is so often amenable to therapeutical influence, and in view of the great danger to the patient that arises from want of immediate treatment, the diagnosis of congestive fever becomes of great importance. Many fatal cases can be traced to want of early recognition of its true nature. We should always suspect its advent when, in paroxysms of the other malarious pyrexiæ, we observe

"An unusual paleness or lividness of the face; an absence of rigors or a sense of chilliness, while the extremities are really

cold; a want of uniform heat after reaction; a disposition to copious or frequent vomiting or purging, with a sense of unusual weight or oppression at the epigastrium; an extraordinary frequency, feebleness, or irregularity of the pulse; much anxiety of countenance, restlessness, or jactitation, or disposition to faintness; considerable delirium or drowsiness; a prolongation of the cold stage, and a less degree of febrile excitement than might have been anticipated; a continuance in the apyrexia of some mental confusion, sleepiness, faintness, or unusual anxiety, or uneasiness. Any of the above symptoms should be a sufficient warning to the practitioner not to delay for a moment the measures requisite for interrupting the paroxysms."*

In the treatment of miasmatic fevers, our main and great reliance is placed on cinchona and its preparations.

"There is no substitute for these. They are universally relied upon for this purpose. In all countries and at all periods, since the discovery of the properties of this invaluable and incomparable substance, amid all the conflicting dogmas of different medical doctrines, Peruvian bark has never failed to sustain its reputation and to answer the expectations that have rested upon it. Amid the manifold uncertainties of medical science, and the perpetual contingencies of medical art; amid the disheartening scientific infidelity which has lately been taking possession of the medical mind, shaking to its deep foundations the firm old faith in the potency of drugs, and threatening to overturn and demolish it

* In the diagnosis of remittent fever, we have to consider the possibility of enteric fever, of pneumonia, of cerebral meningitis, of gastro-enteritis, or of yellow fever. Mistakes from these sources have only to be mentioned to be avoided, in the generality of cases.

altogether,—it is gratifying and consolatory to feel and to know that here, at least, we stand upon solid ground; that here we may hold that there is one great and important therapeutical relationship definitely and positively ascertained and established, defying alike the open assaults of quackery from without, and the treacherous machinations of indolent skepticism from within."*

The preparation of cinchona, almost universally employed, is the sulphate of quinine.

In the treatment of simple intermittent fever, little or nothing is required, during the cold stage, beyond endeavoring to keep the patient warm. Should there be much pain or disturbance of the nervous system, the use of opium is indicated. This may be most speedily made efficacious by hypodermic application —one-quarter of a grain of muriate, sulphate, or acetate of morphia being injected under the skin of the most convenient part of the body. In cases of vomiting and purging, this is the only prompt and reliable mode of administration.

Should the stomach be oppressed, or nausea be present, nothing gives so much relief as an emetic of mustard powder or of ipecacuanha. Spontaneous vomiting is best treated by copious draughts of warm water, rendered alkaline by soda, potash, or lime, if necessary. Sinapisms may be applied to the epigastrium, if nausea and emesis continue unduly.

In cases of great prostration of the nervous system during the cold stage, it is frequently necessary to

* Bartlett on Fevers.

have recourse to stimuli, such as wine, brandy, or whisky, ammonia, ether, etc. If the stomach or bowels do not furnish a contraindication, it is well, also, to give a scruple of sulphate of quinine by the mouth, or a half drachm by the rectum, in order to avert any tendency to the more serious form of congestive fever that *may* follow this peculiarity of the first stage. It is often advisable to continue the use of quinine, every two hours, in doses of two-thirds as large, until cinchonism or complete reaction be produced.

For the management of pyrexia, in simple intermittents, little is needed. Cold sponging of the body relieves the burning heat; sinapisms or other rubefacients give ease to the neuralgic pains; gastric disturbance should be treated by means already indicated, and by the administration of carbonic acid. Cold drinks, not in too large quantity, assuage the thirst.

During the sweating stage, nothing is needed more than to be careful that the patient does not take cold from exposure.

The practice of venesection, so much lauded by many authors, has not been alluded to, because there is no end attainable by it that may not be more easily secured by other means which are comparatively destitute of danger, and which do not postpone convalescence by weakening the patient. If it be advisable in any class of people, it is assuredly most

so among soldiers, where a speedy return to duty should be one of the first considerations of the medical officer.

During the intermission, sulphate of quinine should be given in appropriate doses. To this, all other medication is secondary. With it properly applied, all other medicines may be useless. The febrifuge may be given by administering two or three grains every two hours, commencing after the subsidence of the diaphoresis, and continuing the dose until cinchonism be produced, or the interval be passed in safety. Should the patient have had several paroxysms, at uniform and well-marked times, it answers equally well to give a full dose—say ten grains—two hours before the time at which the first symptoms were felt.

Idiosyncrasy must be kept in view, a much smaller amount of the salt being requisite to produce cinchonism in some cases than in others. Occasionally the remedy cannot be borne, from some peculiarity of constitution. Thus in some women it gives rise to menorrhagia or to abortion; in males, to gastric trouble or delirium.

There is no contraindication to its use, from any intercurrent inflammation that may exist. On the contrary, it is urgently demanded in pneumonia characterized by periodicity, as we often see it in malarious countries.

If the sulphate of quinine should not prevent a

subsequent paroxysm, it will render it milder, and will soon check the disease entirely. Its use should be continued for at least two days beyond that on which the patient was last free from fever.

On the seventh, fourteenth, and twenty-first days, counting from the last attack, the patient should take ten grains of quinine, two or three hours before the time of day at which his last chill took place; or commencing two days in anticipation, he should take each day as much as half a scruple.

It is desirable, in all cases, to give the remedy in solution or suspended in water, when practicable. If administered in the form of pills, these should be recently made.

Where the stomach cannot tolerate the febrifuge, we may use it by the rectum, taking care to increase the dose one-half.

In all such cases a complete solution should be effected by the addition of a drop of elixir of vitriol or dilute sulphuric acid for each grain of the salt. An opiate may be advantageously combined with it, where irritability of the rectum exists.

The use of opium or of capsicum, in some cases, increases the tolerance and efficiency of the quinine. From one to two grains of the former, or its equivalent, in one of the morphine salts, with ten grains of the latter, may be used.

In obstinate cases, the paroxysm is more apt to be averted, when the patient is kept in bed for an hour

before and an hour after the time at which the chill is expected.

There is no special medication, beyond that already indicated, necessary in the treatment of ordinary intermittent fever.

Where failure attends our efforts to subdue the disease in the manner indicated, it is well for the physician to examine into the quality of the febrifuge. The temptations to adulterate have been strong, and in many instances the article dispensed is consequently inefficacious.

Should the disease have already lasted some time, it will be found advantageous, in obstinate cases, to combine the quinine with iron and capsicum, in the proportion of two grains of the former with one grain of dried, powdered, ferruginous sulphate and an equal quantity of red pepper. A pill thus composed may be administered every three hours during the day, until thirty have been taken.

Chinoidine may be substituted for sulphate of quinia, by doubling the dose. It answers, in some instances, where an idiosyncrasy exists, preventing the use of the latter. It is far from uniform in strength. Of sulphate of cinchonine, the same remarks will apply with regard to relative efficacy.

Salicine is efficacious in many instances. It should be given in at least three times the dose recommended for quinine. The same may be said of *beeberine* and *cornine.*

It is not deemed necessary here to mention all the proposed substitutes that have been suggested for the active principle of Peruvian bark. It is sufficient to say that none of them have stood the test of experience, when compared with the great remedy.

In rebellious cases, the *arsenite of potassa*, as administered in Fowler's solution, is by most practitioners thought to rank next after quinine as a curative agent. It should be given in ten-drop doses, in water, *after eating*. This seems to insure its more speedy action, and to prevent gastric irritation. Care should be taken to suspend its use as soon as the facial œdema or articular pains it causes appear.

In patients who need a tonic, after the disappearance of the fever, there is nothing more advisable than the use of the nitric or nitro-muriatic acids. By some practitioners, indeed, the former is considered one of the most trustworthy febrifuges we possess. The *quinine bitters* are admirable for this purpose.

The practitioner should not fail to remember how often the effect of any strong impression on the mind serves to put off an intermittent paroxysm. A confident assurance, with certain psychological constitutions, has often prevented an attack of ague. The well-known plan of administering a powerful emetic, as the infusion of boneset, an hour or two before the time for the chill, is well to be kept in mind.

If practicable, it is advisable, when antimalarious

remedies fail, to remove the patient from miasmatic influence. This alone, in cases apparently intractable, has sufficed for a cure. The almost universally beneficial effects of a sea voyage are well proved.

In the treatment of *Remittent Fevers*, our endeavor should be to put the patient as soon as possible under the influence of quinine. Much harm is done by the practice of waiting to "prepare the system," before administering the only really efficacious remedy. There may be instances, it is true, in which it is necessary to treat disordered conditions of the stomach or bowels, before the febrifuge can be taken; but such constitute exceptions to the general rule. *It may be taken as an axiom, that the sooner we produce the state of cinchonism, the more speedily and certainly the disease will be subdued.* Traditional belief that inflammation contraindicates the employment of cinchona still unhappily influences the minds of many whose experience in miasmatic ailments has been limited; thus allowing their fears of an imaginary evil to stand in the way of doing the only positive good to be effected by medication, in breaking up the fever.

Should there be irritability of the stomach, so great as to prevent retention of the quinine, the same course of treatment should be resorted to that has already been recommended for intermittent attacks. If the state of the bowels requires a purgative, there is nothing more easily borne or more excellent in its

effects than calomel. This may be given by combining ten, fifteen, or twenty grains of the mercurial with the same quantity of the quinine. Should the dose have failed to purge in the course of six hours, a saline aperient may be advantageously administered. As a gentle medicine of this class, scarcely any is so generally applicable as the infusion of Epsom salt, senna leaves, and fennel or anise seeds. A wineglassful of this given cold, every two hours, is very little apt to be rejected by an irritable stomach, and is very sure to produce the desired alvine relief. Beyond this manner of prescribing calomel, it is doubtful whether it is advisable to go. The habit of systematically salivating patients for the cure of bilious fever is, happily, becoming a thing of the past. Common sense should guide us, after the first purgation, in prescribing such medicines as will tend to prevent constipation.

In case the first dose of quinine should not have produced the peculiar effects of cinchonism within four hours, it is well to continue its use in smaller quantities, say from five to ten grains, at intervals of like duration, until the paroxysms abate materially or the cinchonism occurs. In cases of ordinary severity it may be necessary only to give a scruple of the salt, between the commencement of its administration and the beginning of the next exacerbation. When indicated, the use of opium is of great service, in combination with the quinine. It is desirable to maintain

the influence of the latter remedy for at least two days after the disappearance of the fever. Two grains every three hours will usually be found sufficient to effect the desired end. After this time, the convalescent should be treated as has already been indicated in the remarks on intermittent fever.

So much has been said with reference to the absolute necessity of venesection, for the successful treatment of remittent fever, that it is deemed proper to state the opinion of the best authorities with respect to it. By many, the use of the lancet is discarded, except in very rare cases; by nearly all, its employment is restricted to the early stages, and to a single depletion; while many of our most experienced and trustworthy observers believe that the use of cold affusion is competent to produce every result that would be expected from phlebotomy, with much more certainty and with much less danger to the patient. The fear of failing to bleed in inflammations is much diminished, since modern pathology has served to increase our acquaintance with the natural history of disease. How often have the subsidence and disappearance of supposed encephalitis been witnessed under the influence of efficient doses of sulphate of quinine! How often the amendment and resolution of a pneumonia in like cases of miasmatic poisoning!

No better rule can be given for applying the cold affusion than that laid down by Dr. Dickson: "Seat your patient in a convenient receptacle, and pour

over his head and body, from some elevation, a large stream of cold water. Continue this until he becomes pale, or the pulse loses its fullness, or his skin becomes corrugated, or he shivers." He is then to be wiped dry and put to bed. A remission, thus artificially produced, will follow, and may be reproduced in the same manner, if necessary. In case the chilly feelings continue too long, the length of the next affusion should be lessened.

Singular relief is often given to violent pain in the head by this means. It may almost be compared to the effects of an anæsthetic inhalation, in many instances. Dry cupping to the nucha and temples is serviceable.

For the urgent thirst of an exacerbation, nothing is so grateful and advantageous as the effervescing draught of the U. S. Pharmacopœia. This not only diminishes the desire for drinks, but is, perhaps, the most efficient diaphoretic we possess. It is infinitely preferable to the common and distasteful spirits of Mindererus. When the stomach is tranquil, small quantities (a thirty-second part of a grain) of tartar emetic every two hours are beneficial. This is always attainable, is tasteless, and is prepared by putting a grain of the salt to a pint of water; dose, one tablespoonful. It is well understood that cold water or ice are to be allowed in small quantities and at frequent intervals.

For the gastric irritability, when severe, we may

prescribe acetate of lead, one grain every hour or two, in solution; hydrocyanic acid; creosote; chloroform; lime-water; epigastric blistering and endermic use of morphia; cold mint-julep; opiates, by the mouth or by the hypodermic syringe. Occasionally a mustard plaster applied to the spine will prove efficacious.

During the exacerbations, the patient will not need more nourishment than is contained in barley, rice, or gum arabic water. Tea and coffee, taken cold, are often most grateful as well as useful, from their stimulant qualities. As soon as the appetite demands and the stomach will tolerate them, it is well to administer nourishing animal broths. Frequently cold milk and lime-water will prove all-sufficient for diet, and will be retained, while other food is rejected or causes epigastric distress.

In those instances in which, after eight or ten days, the disease proves intractable, and shows a tendency to pass into a form resembling typhus or typhoid fever, the treatment should consist of support, and such medicine as particular symptoms may require.

It is needless to say that premature exposure, in any way, is to be avoided; that just care should be paid to having a proper quantity of nutritious, easily-digested food, and that all possible hygienic precautions should be observed.

In describing the treatment of *Congestive Fever*, much might be written, but it would be of little benefit to the practical physician after what has preceded. To recover the patient from the stage of collapse, bleeding and mercurials are mentioned only to be condemned. The use of cold baths, or cold affusion, as described under the head of remittent fever, is perhaps as satisfactory and practicable a method as can be followed. When conveniences for this are wanting, the use of dry cups to the spine, warm applications to the surface with bricks, bottles, or the hot-air baths, and friction of the skin are to be recommended. The first indication is the same that has already been stated, viz., to produce the specific influence of quinine as soon as possible. It is doubtful if it be necessary to give more than a drachm in any interval. Never wait for intermissions; let positive inability of the stomach or rectum to receive the medicine be the only obstacle to its administration. In desperate cases, raise one or more blisters by boiling water or by ammonia; sprinkle the denuded cutis with the sulphate of quinine, reduced to the finest possible powder, covering the surface with oiled silk afterward. Great caution is needed during convalescence, rules for practice in which may be gathered from what has been said under the head of remittent fever.

No stress has been laid on the matter of prophy-

laxis. All that need be said in addition to the various deductions from what has preceded, is so completely set forth in one of the publications of the United States Sanitary Commission, contained in this volume, as to render further remarks supererogatory.

A SUMMARY

OF THE

SYMPTOMS, DIAGNOSIS, AND TREATMENT

OF

CONTINUED FEVERS.

SYMPTOMS, DIAGNOSIS, AND TREATMENT

OF

CONTINUED FEVERS.

Fevers are divided into Essential, or Idiopathic, and Symptomatic: the latter depending solely on some local affection, are not considered here. The former are subdivided into Remittents, Intermittents, and Continued Fevers, to which may be added, as coming strictly into neither of the above families, Yellow Fever.

From the widely extended field of its operations, most of the above-named diseases are prevalent in our army, and all, in their every variety and form, may sooner or later be looked for. It will come within the scope of this paper to deal with Continued Fevers only. Of these there are three,* viz.:—

Irritative Fever, (so called,)
Typhoid Fever, and
Typhus Fever.

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* The *Relapsing Fever* of Great Britain is omitted in these descriptions, being rarely, if ever, seen in this country.

We propose to give, as concisely as possible, the ordinary diagnostic characteristics of these diseases, with some of their symptoms and causes, together with a brief summary of treatment.

I. IRRITATIVE FEVER.

(Syn.) *Simple Fever, Ephemera, Febricula.*

A fever lasting only about twenty-four hours has been described by some writers under the name of *Ephemera* as distinct from Febricula; but they may be better treated as gradations of the same disease passing by insensible degrees into each other, and differing only in intensity.

By the term Irritative Fever is meant that condition of the system which is manifested by a hot skin, a quick pulse, and white tongue, etc., continuing from two to seven or eight days, and referable, so far as our powers of observation go, to no peculiar or specific agency or local disease as its cause.

Course and Symptoms.—It begins with rigors, generally slight, often imperfectly marked yet sometimes severe, followed by chilliness, headache, pain in back and limbs, and soon succeeded by ordinary febrile reaction—a dry, hot skin, frequent pulse, furred tongue, loss of appetite, thirst, constipation, scanty urine, and diminution of the secretions generally. There is no cough, nor physical signs of the chest or abdomen. The symptoms increase in severity for three or four days, and after five, six, or seven

days disappear as suddenly as they began—a critical discharge, a deposit of urates, or a copious sweat, in many cases, marking the moment when the patient regains his health.

Causes.—Very numerous; exposure to cold or intense heat, errors of diet, a debauch, over-exertion and fatigue, the presence of febrile epidemics, etc. Soldiers, after a fatiguing march, exposed to cold and wet, if they afterward remain with their damp clothes upon them, are apt to be thus attacked.

Prognosis.—Uncomplicated, it is never fatal; local inflammations are occasionally set up in its course.

Diagnosis.—From the severer kinds of fever, generally by the mildness of its accession and symptoms; great caution is, however, to be observed here. From the phlegmasia, by the absence of any discoverable local affection.

Treatment.—In ordinary cases, very simple. If great vascular excitement or signs of active cerebral congestion exist, venesection to the extent of from eight to sixteen ounces may be resorted to in a strong man; but this is seldom necessary. Generally an efficient cathartic at the outset, followed by refrigerant diaphoretics, with proper attention to regimen, is all that is required. In the choice of a cathartic, be guided by circumstances. If febrile excitement is intense, sulphate of magnesia alone, or with infusion of senna; if symptoms of acidity be present, the pure magnesia may be added; for hepatic congestion and

deficient hepatic secretion, give two or three compound cathartic pills. Eight or ten grains of Dover's powder at night will generally be of service. If the fever lasts beyond a day or two, the bowels must be kept regularly open by saline cathartics, with the diaphoretics above named in the intervals. All excitements are to be avoided, rest and strictly farinaceous diet enjoined; cold water and simple acidulated drinks, but no stimulants allowed. Should inflammation in any organ be developed, the case is to be treated exactly as an ordinary phlegmasia of that organ.

II. TYPHOID FEVER.

(Syn.) *Com. Continued Fever, Enteric Fever, Abdominal Typhus, Dothin Enteritis.*

This is the ordinary endemic fever of New England, and of those portions of the United States in which the miasmatic or bilious fevers do not prevail. The official army reports show it to be more or less mingled with the latter also within their own especial limits, and rarely to be entirely absent, indeed, in any part of our country.

General Description or Portraiture of the Disease.— An acute affection, resulting from an obscure if not unknown cause, occurring oftenest between the ages of 16 and 33, most prevalent in autumn and winter, but occurring at all seasons, having an average duration of from 21 to 28 or 30 days, sometimes sudden,

but more often gradual and insidious in its approach; its access—after a few days of indefinable illness and discomfort, headache, inaptitude for bodily or mental effort—being attended with chilliness, usually slight and often repeated, soon followed by more or less febrile heat of the skin, accelerated pulse, and respiration; a whitish, furred tongue; slight dry cough; sonorous râles; pain in back and limbs; apathy, anorexia, thirst, a tendency to diarrhœa, occasional epistaxis; vertigo, especially in assuming the upright position; tinnitus aurium, hebetude of mind; as the disease advances, loss of muscular strength, perversion of the intellect, low delirium, increased diarrhœa, tympanites, pain in abdomen, tenderness and gurgling over iliac region; dry, hard, brown, or black tongue; with the appearance, after the tenth or twelfth day, of a peculiar eruption, coming out in successive crops, of a delicate rose-color, few or many, which vanish under pressure, confined mostly to the anterior and posterior surface of the trunk, attended by sudamina on the chest and neck; still later, in severe cases, increased abdominal pains and tenderness, meteoric distention, frequent diarrhœa, sordes, subsultus and sinking of all the vital powers, and death from the second to the fourth week; or, at a variable period between the twelfth and thirtieth day, a gradual diminution of all the symptoms, merging in convalescence and recovery.

Causes.—Its essential causes are by no means well

determined. Age as a predisposing cause, recent residence in town, and, at times, contagion, (to those who are constantly in immediate relation to the sick only as a rule,) are the circumstances and conditions that may give rise to the disease. Among the immediate causes must be named the ordinary excitants of disease in camps—errors in diet, excesses, exposure to cold or heat, extreme vicissitudes of weather, strong moral impressions, etc. Soldiers recently from the country, quartered in or about our large towns and cities, are more than ordinarily subject to this fever.

Forms and Varieties.—This disease is liable to present itself under different phases or forms in different seasons and in different localities, and often, at different times, in the same season and locality. Such are in general the inflammatory or sthenic, and the debilitating or asthenic. But these differences in form, it is believed, belong rather to the first stages of the disease, adynamia almost always marking its later periods. There is also a *latent* form of the fever, in which the symptoms from the outset are of the mildest character. The patient, unable to fix upon any particular day as that on which his illness commenced, feels ill, weak, languid, chilly, loses his appetite, and suffers from slight frontal headache. He is listless, unapt for his usual occupations, lounges about, perhaps lies down for a part of the day, and, feeling better, makes an effort to exert himself, goes

out, but soon returns fatigued, and lies down again. At night there is generally some increase of the symptoms denominated febrile, the pulse rises, the skin is hot, and the patient is restless and uneasy; some days he is better, some days worse; there is no discoverable lesion, there may be a little cough, with slight sonorous râle, or there may be some leaning toward diarrhœa, with a little pain and tenderness in the abdomen. There exists no tangible disease, but the symptoms continue for days and weeks, without abatement or much variation. Such cases may terminate in two ways—slowly after a month or five weeks, in the gradual disappearance of all the symptoms, and returning health; or, suddenly, with intense abdominal pain and vomiting, extreme distention, coldness of surface, sinking, and death from perforation of the intestines.

Diagnosis.—This must be rational, not absolute—that is, not founded on a few positive physical signs. There is no one symptom—there are no two or three symptoms which, in themselves, are characteristic of the disease; nor is there any one symptom or group of symptoms, usually occurring, which may not be absent during its entire progress. The most common and marked characteristics are its insidious attack, the early headache, apathy, dullness and perversion of the senses, tinnitus, dry cough and bronchial râles, tendency to diarrhœa, epistaxis, pains in abdomen, tenderness, and gurgling; and later, the appearance

of the rose rash, with sudamina, tympanites, light-colored liquid stools, stupor, low delirium, and adynamic condition generally. These, in mild, average, and severe cases, being mostly present, leave little doubt of the nature of the malady. It is important early to recognize the latent form described above, and the value of the precautionary measures it naturally suggests. The disease may be confounded, in its early stages, with the bilious remittent, if within the sphere of the latter affections,—especially if, as is believed by Dr. George B. Wood, the two diseases may be somewhat commingled in consequence of the co-operation of their causes; cases (as that distinguished authority asserts) having all the essential characters of typhoid fever, occasionally ending in intermittents; and bilious fevers or affections which cannot be distinguished from them, sometimes showing the symptoms of typhoid fever during their progress. But the pure remittents may be commonly known by their more decided remissions, the bilious vomiting and yellowness of skin, shorter duration, more abrupt accession, and absence of the prominent adynamia or general prostration; the rose eruption, of course, is never seen. A hasty diagnosis, in miasmatic regions particularly, should be avoided; and while in doubt, give the benefit of the doubt in favor of the disease now under consideration.

Treatment.—Various, and, to some extent, opposite modes of management have, at different times, been

advocated and adopted. The balance of authority is in favor of a rational, symptomatic, expectant plan of treatment, adapted—as far as common sense and experience will enable us—to the varying state and condition of the patient in different forms of the fever, and the several stages of its progress. In few diseases are the beneficial effects of active medication less marked and obvious. In no disease is the benefit of the watchful care and attention of the physician more apparent.

At the first onset of the disease, the patient should desist from his ordinary duties, abstain from food except of the mildest and simplest kind, and be placed in bed, or, at least, in a state of repose. Attempts to jugulate the fever by violent emetics and cathartics are opposed to reason and experience, and may prove of incalculable mischief in the end; and all delay and forced efforts to "stave off" the attack will prove of no avail. At the commencement of the disease, if the patient has eaten immoderately, or signs of irritable injesta in the stomach are present, an emetic of ipecac. ʒss may be administered. The bowels should also be evacuated by a mild cathartic, sufficient to clear them of all irritating matter; a moderate dose of castor oil, either alone or in emulsion, will do this effectually and without danger. Afterward, the bowels should be kept moderately open during the whole course of the disease. Often there is diarrhœa throughout, and always an unusual

sensitiveness to the influence of cathartic medicines; the gentlest laxatives, therefore, and those in small doses, will be sufficient. If the evacuations are free and spontaneous, none will be required; if gastro-intestinal irritation be severe, mucilaginous enemata should be substituted. But all unnecessary agitation of the intestinal track is to be scrupulously avoided, bearing in mind the great sensitiveness of that region, and the peculiar lesions which, in all forms and grades of the disease, are the essential pathological elements of the fever in question.

Sometimes in its early stages, in a plethoric and robust patient, when the pulse is full and strong, and there is much pain in the head, flushed face, and obvious active congestion or inflammation of the brain or other vital organ, a single bleeding may possibly be resorted to with benefit. This, however, is the very rare exception, not the rule; and a few leeches to the temples or in the immediate vicinity of whatever important organ is thus threatened, are almost always to be preferred, if blood is to be taken at all. Experience is decidedly against it under any circumstances, after the first week. If now the case become of moderate or even average severity, all perturbating treatment is to be avoided. Care, watchfulness, and good nursing is the sum and substance of the therapeutical management in such cases: the tendency of the disease is toward health, and there is no evidence that the dangerous complications, which are

likely to occur, can be prevented by any active interference. In severer attacks, the symptoms must be met as they occur, having due regard to the vigor and strength of the patient. To moderate excessive heat of the skin, warm, tepid, or cold sponging is indicated; where there is much debility, diluted spirit may be substituted. The nervous symptoms, restlessness, wakefulness, and subsultus, are best alleviated by camphor-water or Hoffmann's anodyne, and by opiates in small quantities, when not contraindicated, at night; laudanum enemata are of great value, when sleep is required to be induced in such cases, and tend rather to diminish than increase cerebral congestion. But for excessive subsultus with a brown tongue, brandy is the appropriate remedy. Simple diluent drinks are, at all times, beneficial; of these pure cold water is the natural febrifuge; a weak infusion of flaxseed (℥ss to water Oj) taken when cold, often and in small quantities, is especially appropriate, and always palatable and grateful to the patient; give them abundantly, as often as they may be desired. If tympanites is extreme and painful, a mucilaginous enema containing ℥ss of turpentine will oftentimes give signal relief. Blisters to the ankles and inside of the calves will sometimes revive the patient, when the lungs are congested and he is seemingly in articulo mortis.

In the debility attendant upon the advanced stages of the disease, tonics and stimulants become abso-

lutely essential; they must be adapted in activity to the degree of prostration, and yet must be exhibited with caution. The precise points at which stimulants are demanded is often a nice question to determine. The early appearance and persistence of an adynamic condition may call for their adoption at the outset, and during the whole course of the disease; in such cases they are to be given boldly, without reference to any dogmas of their contraindication in certain stages. The pulse is a safe guide; if frequent, hard, and quick, stimulants are contraindicated; if frequent, small, and compressible, or infrequent and compressible, they may be given with safety. In doubtful conditions, the practitioner should carefully watch the effect himself, administering the medicines, if need be, with his own hands. On his faithfulness in this particular the life of the patient may depend. Among the most efficient of these agents are the pure wines, brandy, and the carbonate of ammonia.*

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* Among the most suitable of the stimulants is *wine-whey*. It should be prepared by adding one part of good (Sherry) wine to two parts of boiling milk, and straining after coagulation; of this from a tablespoonful to a wineglassful may be given every two hours. *Brandy* is often advantageously administered in the form of *milk-punch*, made with one part of brandy and two parts milk, and given in doses of one, two, or three tablespoonfuls every hour or two. *Carb. ammoniæ* should be administered in doses varying from grs. ijss to grs. x every hour or two, and is best

Local Affections and Complications.—Where there is obstinate delirium and coma, the head should be shaved and a blister applied to the scalp. In copious and alarming epistaxis, occurring at any stage of the disease, recourse must be had to plugging the nostrils anteriorly and posteriorly. Hemorrhage from the bowels, a grave but by no means an invariably fatal symptom, is to be treated by injections of starch with laudanum, by the acetate of lead in pill, or other astringents. Dr. William Ashmead has found great efficacy, in *threatening cases* of intestinal hemorrhage, from the administration of kino in large doses. Dr. Wood has employed the same remedy in such cases with signal success. He uses it "almost without limit," as "freely as the stomach will tolerate it." Thus "a teaspoonful of the powder may be given at once, and repeated at such intervals as the case may seem to require, till the hemorrhage ceases." Laryngeal obstruction from œdema—a peculiar and dangerous complication—sometimes occurs in this and other

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given in emulsion. The following formula may be used: R. Am. Carb. ʒii, Acaciæ pulv., Sach. alb. āā ʒii, Aq. Menth. p. vel Aq. fluv. fʒvi. M. From a teaspoonful to a tablespoonful to be taken every hour or two, diluted with a little water.—*Note to Wood's Practice of Medicine.*

When stimulants are moderately required, and in the hemorrhagic state, a judicious use of the tinct. chlo. ferri. is often advantageous.

low fevers, requiring immediate and prompt attention by scarification of the glottis or tracheotomy. Peritonitis from perforation can only be treated by the exhibition of large doses of opium, abstinence from all food, and absolute and motionless rest, and this with a well-nigh hopeless chance of success. Sloughing, in tedious cases, may be obviated by frequent changes of posture, and a judicious use of pillows of bran. In the aggravated forms of the fever, the state of the bladder should be daily attended to.

A peculiar state of the tongue, seen not unfrequently in this disease in its advanced stages, has been considered as indicating an aggravation of ulceration in the ileum, and is often treated successfully by the administration of the oil of turpentine in small doses; it is when in the advanced stages of the disease, after cleaning partially in flakes, the tongue becomes suddenly hard and dry, with increase of tympanites and aggravation of all the other abdominal symptoms. In such cases, Dr. Wood advises the administration of from five to ten or fifteen drops of the oil, in emulsion with gum arabic and loaf-sugar and water—adding a little laudanum occasionally if it disturb either the stomach or bowels. In the course of twenty-four or forty-eight hours the tongue becomes moister, the tympanites diminishes, the pulse is less frequent, the skin less harsh and dry, and the patient enters slowly but regularly into convalescence. Thirty years of experience has con-

vinced this accurate observer of the efficacy of the treatment in such cases.

When the disease is evidently of malarious origin, or is complicated with bilious remittent,—as it may be in districts where the miasmatic fevers prevail,—and especially if, under such circumstances, an intermittent form of the fever supervene, bark or the sulphate of quinine should be used without hesitation, and with a freedom proportioned to the urgency of the symptoms. But the general and indiscriminate use of quinine in this disease cannot be too strongly condemned.

Attention to the diet is all-important throughout. In the early stages it should be light, consisting of liquid substances chiefly; the infusion of flaxseed, toast-water, barley-water, weak solutions of tapioca, sago, or arrow-root are mostly to be employed; gruels made of Indian-meal are to be avoided. Slightly acidulated drinks or pure water may be given, as the patient prefers. In the advanced periods, when symptoms of debility appear, a more nutritious but not stimulating diet is necessary. The farinaceous articles above mentioned, made with a mixture of one part water and three parts milk, may now be given; wine, if desirable, may be added. Pure milk or milk and water may sometimes be substituted with benefit. And in the last or prostrate stage, the diet must not only be nutritious, but stimulating, such as the animal broths or jellies, with wine, milk-punch, or

brandies, or, if these cannot be had, the essence of beef and mutton.*

During convalescence, the closest watchfulness and care is demanded; the bowels are to be kept open by the mildest laxatives or emollient enemata, but active purgation, premature exposure, fatigue, excitement, and all indiscretions in diet are to be scrupulously avoided.

III. TYPHUS FEVER.

(Syn.) *Typhus gravior, Ship Fever, Camp Fever, Hospital Fever, etc.*

Sketch of the Disease, involving its Prominent Symptoms and Progress.—It is an affection sudden and severe in its accession, common to all ages, ushered in by lassitude, depression, rigors, anorexia, headache,

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* *The essence of beef or mutton* may be prepared in the following manner: The muscle, deprived of fat, is cut up finely, and introduced, without water, into a narrow-necked bottle, which, after being loosely corked, is exposed for an hour or more to a boiling heat in a pot of water, in which it is so placed that the top of the bottle is above the surface of the liquid in the pot. At the end of the process, the liquor which may have formed in the bottle is poured off, and constitutes the preparation in question. It is a concentrated solution of the soluble principles of the meat, is powerfully stimulant, and in the quantity of from a teaspoonful to a tablespoonful, repeated at intervals of half an hour, an hour, or two hours, aids greatly in the support of the system in this and other low states of disease.

pains in back, limbs, and joints; accompanied or soon followed by loss of strength, dullness of the intellect and special senses, perversion of memory, stupor, dusky and hot and pungent skin, flushed face, suffused eyes, furred and loaded tongue, accelerated but moderately full, soft, and compressible pulse; without any considerable deviation, in its simple uncomplicated form, from a normal condition of the chest and abdomen; general sensitiveness of surface, a strong peculiar nauseous odor of the body; exhibiting, on or about the fifth day, an abundant characteristic rash, first seen on the arms, upper part of the chest and legs, later on abdomen and back, never on the face, the approach of which is heralded by an indistinct mottled and roseate appearance of the surface, seemingly subcuticular, which rash is at first light, pinkish, florid, isolated or clustered, simulating not unfrequently the eruption of measles, then darker, more or less persistent, increasing in abundance and intensity for several days, sometimes livid and petechial, fading on or about the tenth day, and disappearing in the order in which it came from about the twelfth to the sixteenth day; which symptoms may vary in intensity and relative importance, may vacillate from better to worse, from worse to better, or remain stationary, or diminish in intensity till they are merged in convalescence; or may be aggravated and receive accessions, the tongue become dry, swollen, fissured, black, with accumulations of sordes

on teeth and lips, fuliginous face, burning skin, livid and petechial spots, hurried, interrupted, imperfect respiration, an exceedingly rapid, feeble pulse, extreme muscular prostration, coma vigil or great nervous agitation, simulating at times the busy excitement of delirium tremens, with sometimes coolness of surface and profuse sweating, terminating at a variable period between the twelfth and twentieth day, often earlier, rarely later, in death.

Causes.—Our knowledge of its efficient causes is limited and imperfect. Among the circumstances most frequently associated with its appearance are the crowding together of persons in dark, damp, badly ventilated apartments, coupled with anxiety, fatigue, want, deprivation, and misery. The very intimate connection of typhus with crowded and confined apartments, where the excretions and filth are allowed to accumulate, has been universally admitted; hence the disease has often made its appearance in camps, ships, hospitals, and garrisoned towns. "This is the pestilence which dogs the footsteps of retreating and discomfited armies, and takes up its dwelling in their tents,—which hides itself within the noisome walls of ancient prisons." Its history shows it to be often dependent upon that unknown influence, or combination of influences, to which the term epidemic has been applied. And when once engendered, from whatever cause, it has been almost universally regarded by those whose opportunities have

best fitted them to know, as capable of direct transmission by contagion.

Yet the disease must not be held as contagious in the same sense that small-pox is contagious, viz., that it is invariably and virulently so. Certainly the sphere of action is more limited, the communication of the poison more dependent on circumstances, and the morbific influences more within the control of sanitary laws and regulations than in the usual zymotic, or so-called contagious maladies. It may be stated in general terms that the contagion, to be effectual, must be concentrated by the crowding together of patients, or accumulated and aggravated in ill-ventilated and pent-up rooms, or stimulated by the conjunction of other unfavorable hygienic conditions, ill drainage, filth, effluvia, etc., or the recipient have been previously subjected to the predisposing causes, by deprivation, hardship, and want, excesses, anxiety, fear, despondency, mental and physical exhaustion, or debility from any cause, till his system has been brought to a point below the power of resistance. It follows that immunity from the reception of contagion in the exposed, and from an aggravation of horrors on the part of the sick, is to be obtained, as far as possible, by a strict observance of the well-known maxims of hygiene—first and foremost among which is the possession of a stout heart, and a sufficiency of the light and air of heaven. Hence an explanation of the fact that, in the sheds and shanties, open to

the elements, which of necessity have been resorted to when the disease has sprung up suddenly and prevailed extensively, both patients and attendants have fared the better.

Varieties and Forms.—These are only such as depend upon different degrees of severity, and are more or less constantly connected with the different seasons of the year. Some epidemics may be characterized as mild, others as severe; and, in the same visitations, may be found every grade between the two extremes. During the winter and spring, the fevers will most likely be complicated with pulmonic affections; in summer and autumn, with gastro-intestinal irritation, perhaps; and, at uncertain times and seasons, grave consecutive affections may supervene.

Diagnosis.—Among the chief characteristic symptoms are the following: abruptness of the attack, the early and great prostration, the rash, the dusky hue and sensitiveness and peculiar odor of the surface, the passive engorgements, tendency to muscular and nervous agitation, and freedom from important local derangements. Thus the accession is sudden, preceded only by a day or two of trifling ailment, and accompanied very uniformly by anorexia, rigors, nausea, pains, hot skin, depression, and headache. The depression is an early and almost constant attendant; the strength soon becomes exhausted, the mind and memory confused, and the spirits despondent. This exhaustion continues till, in the

acme of the disease, the powers are completely overwhelmed. The hot skin is often excessive. It is peculiar, dry, burning, and pungent to the feel. On the fifth or sixth day the characteristic rash appears. The dusky face and fuliginous hue of the body is a common accompaniment; it is noticed early, and deepens as the fever advances. Conjoined with this, and bearing an appreciable relation to its intensity, is the marked and pungent emanation from the general surface, which has been previously described as mousey, mawkish, ammoniacal, etc., furnishing to another sense a testimony of the specific nature of the malady. A muscular unsteadiness is early apparent —a tremulousness of the hands and of the tongue, the culmination of which may be spasms and convulsions. Delirium, in greater or less degree, is an almost constant concomitant. It is not unfrequently accompanied by the wakefulness and excitement and busy activity of delirium tremens, which it closely resembles. More often, the early somnolence is attended by muttering and talking, a state which generally passes into stupor or coma, the patient lying supine and utterly unconscious. The respiration is peculiarly affected; it becomes quick and labored—it is impeded and interrupted, amounting sometimes in frequency to forty, fifty, and even sixty in the minute. And yet there is remarkable freedom from any important structural disease. The diagnostic marks of cerebral inflammation are wanting. Auscultation and

percussion fail to detect any abnormal signs in the chest. The abdomen is natural in appearance, and free from any considerable tenderness or tympanites. There is no diarrhœa. The bowels may be a little relaxed, but the stools are regular and easy in their action. More often there is a tendency to constipation throughout. Neither the liver, the kidneys, the stomach, nor the intestines give evidence of any especial organic disturbance.

Treatment.—In general, pure air, cleanliness, quiet, and good nursing are all important requisites. Bland nourishing food and drinks, given frequently and in small quantities, are in most cases demanded throughout the whole course of the disease. Conjoined with such hygienic measures, the use of mild evacuants, of diaphoretics, nervous and arterial sedatives or stimulants, as the case may require, together with the usual means to mitigate febrile action, constitute the whole of the general plan of treatment. The details must be varied according to the circumstances which may arise during its progress, so that while the general management of the case may safely be trusted to the faithful and intelligent nurse, it is the province of the physician to obviate injury to the vital functions, and combat in turn the graver symptoms as they present. Measures should be early adopted to prevent the spread of the fever by contagion. We have already named the conditions under which this element becomes active. Happily the conditions re-

quired for its amelioration are those which experience has shown to be best for the patient.*

Should wards and walls be necessitated by the rigors of the season, blazing fires and open windows become imperative; and here, as already suggested, due attention to ventilation, cleanliness, and the non-

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* The following rules, the observance of which is enjoined by the Government of the London Fever Hospital, might well be adopted under similar circumstances in Millitary Hospitals, *passim*.

"I. It is of the utmost importance to the sick, and their attendants, that there be a constant admission of *fresh* air into the room, and especially about the patient's bed—care being taken to prevent the wind from blowing directly on the patient.

"II. Attention to *cleanliness* is indispensable. The linen of the patient should be often changed; and the dirty clothes, etc. immediately put into fresh cold water, and afterward well washed. The floor of the room must be cleansed every day with a mop, and all discharges from the patient immediately removed, and the utensils washed.

"III. Nurses and attendants ought to endeavor to avoid the patient's breath, and the vapor from the discharges.

"IV. Visitors must not go near to the sick, nor remain with them longer than is absolutely necessary; they should not swallow their spittle, but clear the mouth and nostrils when they leave the room.

"V. No dependence must be placed on vinegar, camphor, or other supposed preventives; which, without attention to *cleanliness* and admission of *fresh air*, are not only useless, but, by their strong smell, render it impossible to perceive when the room is filled with bad air or noxious vapors."

crowding of patients, will go far to lessen the chances of communication.

In the formative stage, that is, on the *first day* of the sudden accession of symptoms of the fever, (not later,) if there be no gastric disturbance, a full emetic of ipecac., sulphate of zinc, or mustard may be given, in hopes to arrest or cut short its progress. Later than this, or after reaction has supervened, the fever must run its course. Bearing in mind the essential adynamic character of the affection, the indications are now to sustain the vital forces—protect the important organs—modify existing symptoms, and minister to the relief of the sufferer. Attention to diet is always important. The bland articles of nutriment, arrow-root, sago, ground rice, mush, and occasionally the lighter jellies, (if they can be got,) in the acute stage; and when prostration is marked, the animal essences and broths are to be given in small quantities, at frequent intervals, watching their effect. Demulcent beverages, such as the infusion of flaxseed, milk and water, and the like, should constitute the principal drinks. Early in the disease a gentle cathartic is required; castor oil in emulsion is best. This is to be repeated, or emollient enemata substituted, as occasion requires, during the course of the disease. General blood-letting is not well borne in typhus. It is better to discard it altogether. If reaction is excessive, and the vascular excitement intense, or if important organs are particularly involved, de-

manding venesection in ordinary cases, other means are still preferable here, remembering that the disease may, at any time, sink suddenly from a state of apparent exaltation to that of depression of all the vital forces. For local affections, likewise, dry cupping may be used instead of local bleeding; and if violent vascular action is manifest, with burning surface, dry tongue, and full and accelerated pulse, recourse may be had to the administration of a mild solution of tartar emetic, and tepid sponging of the whole surface; or the milder refrigerants and neutral mixture may be sometimes substituted with good effect, unless the bronchial and pulmonary tissues are involved. The intense cephalalgia is oftenest relieved by the application to the forehead of flannels dipped in hot vinegar and water. Nausea and uneasiness of the stomach are best mollified by a sinapism to the epigastrium. Sleep may, in most cases, be induced by minute doses of the sulphate of morphia: $\frac{1}{8}$ or even $\frac{1}{16}$ gr. in solution, given once or twice at intervals of an hour, will often produce the desired effect. The general nervous disturbance, great sensitiveness, morbid vigilance, restlessness, and subsultus are best allayed by camphor, in doses of 4 to 6 grs., either in emulsion or the form of the ordinary camphor mixture. On the signs of adynamia or general exhaustion, recourse is at once to be had to stimulants and tonics, and these once begun are oftentimes to be continued through the course of the fever, sometimes in the

face of conditions commonly demanding an opposite policy. Thus, not unfrequently, while dealing with some severe disturbance by local depletive means, vigorous stimulant measures are, at the same time, to be adopted, in order to keep the general system up to the vital point. Of the stimulants, the strong wines —sherry, madeira, and port—are the best. Combinations of some stimulant and tonic are often beneficial. A mixture composed of sherry and the sol. sulph. quiniæ in equal parts, (of which from ℥ss to ℥j may be taken every two hours,) is most excellent. When the system has been habituated to strong drinks, brandy is preferable. At the same time, beef tea and the nourishing broths may often be administered with the best results.* In the advanced stages, when there is muttering delirium, coma, involuntary evacuations, cold extremities, a fluttering pulse, and rapid sinking of the powers of life, there may be added to the above treatment stimulating injections,

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* Often in conjunction with sherry, beef tea, and milk and water, p. r. n., the following, which are among the standing hospital mixtures in Great Britain, may be given according as the symptoms of prostration, combined with nervous excitement, are more or less urgent:—

1. *Mild Fever Mixture.*

℞ Liq. ammon. acet. ℥ii;
mist. camph.
aquæ distill. āā ℥ss.
M. Ft. Haust.

2. *Strong Fever Mixture.*

℞ Ammon. sesquicarb. gr. v;
mist. camph. ℥jss.
M. Cap. ℥j quâque 4tâ horâ.

hot pediluvia, friction to the spine, dry warmth, flying blisters, sinapism to the inside of the thighs, legs, and arms. Thus the flagging energies may sometimes be arrested in desperate cases.

Local complications and incidental affections, occurring in the acute stage, are to be treated topically but judiciously, bearing in mind the adynamic tendency of the primary disease. *During convalescence*, too much care as to premature exposure, or indiscretions in diet, cannot be observed. The appetite is to be restrained. Demulcent drinks, solutions of gum arabic, and infusions of flaxseed, in conjunction with bland but nutritious food, seem well adapted to this period. Ale and porter are here of advantage, in many cases, if they can be got. Thus, by care and consideration, the *intractable secondary diarrhœa* which belongs to the recovering stage may be avoided, at the same time that the strength of the patient is sustained and increased.

Note.—No better evidence of the excellent hygienic condition of our armies could be afforded than the fact of the almost entire absence of typhus fever. In reality, it is doubtful if a single well-marked case has occurred. For some excellent remarks on fevers as they have been witnessed during the rebellion, as well as for much other useful and interesting matter, the reader is referred to Assist. Surg. Woodward's *Outlines of the Chief Camp Diseases of the United States Armies*, a work which should be in the hands of every military medical officer.—W. A. H.

YELLOW FEVER.

YELLOW FEVER.

It will probably fall to the lot of many army surgeons to treat this disease during the occupation of Southern territories by the Union forces.

Inasmuch as it is eminently desirable that easy reference to correct authority concerning its nature and management should be within reach of the medical staff of our service, the Sanitary Commission have thought proper to prepare for circulation the following paper:—

In medical literature the affection is now so well known and so universally recognized by the name at the head of this page as to render unnecessary an enumeration of its synonyms.

Locality.—In America the disease is met with, habitually, in the West India Islands and in the cities of the Atlantic and Gulf shores, south of Charleston, the latter being included. Occasionally its visitations have extended farther north, to Philadelphia, New York, and Boston. Nor have cities and towns on the Mississippi River been exempt from its ravages. New Orleans has suffered many fatal epidemics, while Memphis, in Tennessee, has hitherto

been its northern limit in the great valley. More recently, it has appeared in inland towns and on plantations not remote from the river banks. It is probable that fifteen miles is as great a distance as has been known to exist between navigable water and the locality of an epidemic of this disease. Woodville, in Mississippi, is more remote from the river than any other place known to have been thus visited.

It frequently originates and prevails extensively on shipboard, when the affected vessels have lately been in the neighborhood of places suffering from the fever. In some very rare instances it has occurred in vessels "without the operation of external agencies or the introduction of contagious germs." (*La Roche.*) In 1799 the frigate *General Greene* left Newport for Havana. Before reaching port, yellow fever appeared on board, although Havana, at that time, was free from the disease. When occurring thus, in a majority of cases, "it begins in the vicinity of the pumps and the main hatchways, where the shell of the ship is most dependent, where, consequently, there is the greatest amount of moisture and of heat." In Newcastle, Jamaica, 4000 feet above the sea, Lawson records an epidemic.

Wherever it may occur, there is often a remarkable tendency to limitation as regards the space over which it extends. A berth in a ship, one side of a vessel, a block of a city, one side of a street, may, for a long time, furnish all the cases in an epidemic.

Season.—In the United States, we most commonly meet with the early cases during the months of July or August. The disease is prone to last until the first hard frost. During twenty-one successive years, in New Orleans, the extreme limits between the arrival and departure of yellow fever were the twenty-third of May and the last day of December.

Heat and Moisture.—A certain degree of heat seems necessary for the development of the disease, and it is common to find the opinion expressed that warm, wet weather is propitious to its development. Ample experience exists to prove that but little reliance can be placed on the absence of undue heat and moisture, in the way of insuring exemption from epidemics. The testimony of New Orleans physicians, and of Doctor Blair, in Demerara, conclusively prove that "more or less rain or a greater or less degree of heat has very little to do with the production of yellow fever."

Age and Sex.—Neither of these etiological elements are sources of exemption; nor do they exercise an influence which would make their consideration a matter of importance to the army surgeon. Fever may occur and prove fatal at any time of life. That men die in larger numbers than women admits of a self-evident explanation.

Race.—Negroes *may* take yellow fever, and they may die of it. In comparison with other races, their slight liability to suffer is very remarkable. In the

United States this exemption is observed, in the mulatto, in direct ratio to the amount of African blood. The more Caucasian, the greater liability to sicken and to die. A full-blooded African rarely contracts the disease, even when freshly imported from his native country and placed in the midst of an epidemic.

It has been said, and is generally believed, that robust, stout, or plethoric people are more apt to be attacked than those of opposite temperament. Inasmuch as such persons constitute the majority of individuals liable to the disease, from want of acclimation, we may find a more philosophical explanation of their greater susceptibility than by reference to temperament.

Condition and Occupation.—Of all persons, soldiers and sailors suffer most from yellow fever. It is very fatal among prostitutes. Many cases have been observed, in some of the Spanish visitations, among those suffering from venereal or chronic disease. Any occupation which tends to lower the standard of vitality, or any condition tending to depress the *morale*, is a powerfully determining cause of the malady. Excessive indulgence in sexual intercourse should be especially regarded in the same light.

Acclimation.—Residence for a long time in yellow fever countries is acknowledged to exert a certain prophylactic influence. Thus, "in healthy years, what are called *sporadic cases* are confined to strangers.

In years when the disease does not prevail so generally as to amount to an epidemic, the *grave cases* are confined to the unacclimated. In epidemics, the natives and old residents are frequently mildly attacked; but strangers are very generally seized, and have, in fact, to bear the violence and malignity which belong to the fever."—*Bartlett.*

A person may be said to be thoroughly acclimated *who has previously had yellow fever.* Instances, it is true, are recorded in which two well-marked attacks have been observed; but the experience of all extensive observers goes to prove the extreme rarity of such exceptions to the general rule. It is highly probable that one attack is as completely protective against another, as in the case of small-pox, and this independently of the element of *severity.*

The above remarks apply only to places more or less commonly visited by yellow fever. In the Woodville epidemic of 1844, *nearly every one,* except a few who had previously had the disease, suffered from it.

It is doubtful whether removal to and residence in countries exempt from yellow fever has the effect of lessening the prophylaxis by acclimation. Probably this would not impair the ordinary immunity from a second seizure.

Our knowledge concerning *epidemic influences* is altogether too vague to arrest our attention here. Nor can we foretell whether or not the yellow fever will prevail in any given year, from our present ac-

quaintance with its nature and history. It were equally unprofitable to enter upon the discussion of the numerous theories advanced to explain its essential cause. It is to be hoped that the day may arrive when our ignorance on those points will be enlightened. It is very certain that it has not yet come.

Miasmatic fevers have only to be understood to be distinguished, at once, from the disease under consideration. The following table will explain the principal differences between them:—

Miasmatic Fever.	Yellow Fever.
1st. Exists in the hottest and coldest climates.	1st. Does not flourish in either intense heat or cold.
2d. Affects country localities by preference; rare in cities.	2d. Eminently a disease of cities and large gatherings of human beings.
3d. One attack invites another.	3d. One attack prevents another.
4th. Curable by Peruvian bark or its preparations.	4th. Not curable by these means.

Finally, in many parts of the world scourged by visitations from malarious fevers, yellow fever is unknown.

Contagiousness and Communicability.—These much-vexed points have been most elaborately and learnedly discussed. From the present state of our knowledge, we may fairly infer:—

1st. That there is no danger in allowing contact

between persons ill of yellow fever and others in good health, the latter being in places where the disease does not exist epidemically.

2d. It is extremely probable that certain articles of merchandise, of dress, and of bedding convey a material (fomites) which, under peculiar circumstances, tends to develop the fever.

3d. Infected ships are especially to be dreaded.

4th. To abandon quarantine restraints against yellow fever, is to put a price on human life and barter it for trade.

Symptoms. — Yellow fever may attack suddenly, and this commonly is the case; or it may have the usual prodromata of febrile affections. Generally a chill is the forerunner of the violent pains in the eyeballs, over the forehead or in the neck, back, and limbs; neuralgic symptoms which, in part or assembled, are scarcely ever absent. It will often be observed that the first manifestations of the fever occur in persons during their sleep, having gone to bed in apparent good health. In malarious affections, the immense majority of cases commence during the day, thus affording another element in which they differ from "the peculiar fever of a single paroxysm" considered in this paper.

When premonitory symptoms exist, they are either neuralgic—generally headache—or the patient complains of languor, anorexia, furred tongue, or of chilly feelings,—these disordered conditions preceding, it

may be by two or three days, the almost inevitable chill.

After this succeeds the *febrile stage*, furnishing, as a rule, no extreme heat of body nor quickness of pulse; in fact, in many instances, the ordinary pyrexial phenomena are so slightly manifested as to afford no indication of the real gravity of the case. Even should there be undue heat of skin, it rarely lasts beyond twenty-four or forty-eight hours—to be followed, on cessation of the fever, by a decided diminution of temperature below the healthy standard. Not often strikingly dry, the cutaneous surface may be gently moist or profusely perspiring. Many observers have recorded the common fact that the skin seems to be in an *atonic* state. The capillary circulation is *easily congested*, and irregular in its distribution, and there is a great tendency to fall of temperature in parts of the body left uncovered for a short time. This point is of exceeding importance in the treatment.

To the febrile stage succeeds that of *calm* or *apyrexia*, in which many or all serious symptoms may seem to subside. This may be the commencement of true convalescence, but it is too often the prelude to the third stage—that of *collapse* and death. Sometimes a fever of reaction follows the second stage, terminating in recovery or death, as may be. In yellow fever the pulse is accelerated, but not, according to general experience, to the same degree as in

nearly all other serious diseases of febrile or inflammatory nature. In different epidemics it varies in regard to strength, sometimes being full, hard, and bounding; at others, small, soft, and easily compressed. During the post-febrile stage, it is typically adynamic; often feeling as though the artery were filled with gas instead of blood, so remarkably unresisting is it to the pressure of the finger: extreme slowness is often conjoined with these latter characteristics. In the last case treated by a member of the committee, it was only forty to the minute, for several days; having previously been as high as one hundred and twenty. Great muscular soreness is often complained of.

The state of the tongue varies in different epidemics: it is usually furred, with whitish or yellowish-white coating of epithelium until the latter stages, when it may be red and smooth, the papillæ having seemingly disappeared. Sometimes it is natural in shape, with the coating already described, and with a red narrow margin and tip. At others, large, flabby, milk white, and bearing marks of the teeth against which it has pressed. Sordes around the teeth are rarely observed. In the late stages, the tongue may present the dry and brown appearance of typhus. *Anorexia* generally characterizes the disease until the commencement of convalescence. Rush mentions the fondness for tobacco as being remarkable with some of those under his observation, one patient

continuing to chew, through every stage of his fever. Of *thirst*, we may say that there is, usually, no great desire for drinks. In some epidemics, however, (as at Portsmouth, Va.,) the thirst was so urgent that the desire for cold drinks could not be satisfied.

Nausea and vomiting scarcely ever fail to command our attention in a well-marked case of yellow fever. Gastric disturbance, thus evinced, is generally one of the early symptoms. At first the matters vomited consist of the contents of the stomach, and are not characteristic. To these, mucus, bile, and perhaps a streak or speck of blood, may succeed. According to Dr. Blair, the ejecta, thus far, are of *alkaline* reaction. Emesis may continue from first to last; but, as a general thing, when once the stomach has been well emptied, it becomes quiet until some time between the second and fifth day; then, with or without an apparent exciting cause, it manifests irritability, and a quantity of clear, pale, or opalescent *acid* fluid is thrown up. This has received the name of *white vomit*. Dr. Blair looks upon this as being coincident with the cleaning up, reddening and smoothing of the tongue, already referred to. Exceptionally, bile may be ejected at this stage. Its appearance may be regarded as a good prognostic element.

When emesis does not cease shortly after the above-mentioned characteristics have shown themselves, the white vomit is apt to contain small, snuff-

like specks, forming a sooty sediment. This is the commencement of *black vomit*, which may now be confidently looked for. This well-known fluid, of bad omen, has received much consideration of late years. It is not always black, but has been noted as being "dark, dark coffee color, dark chocolate, and dark green." In some cases it is brown. All these shades of color are due to that of the hæmatoidin, in each particular case. Blood globules presenting a normal appearance are not met with in ordinary black vomit; but the shriveled cell-walls, dyed brown, constitute a portion of the sediment—colorless, granular, epithelial scales composing the remainder. All infusorial and cryptogamic elements found in the fluid are to be regarded as accidental. When allowed to stand for several hours, an opalescent or clear supernatant fluid is left, after the sedimentary deposit has occurred. Muriate of ammonia has always been found present, by the analyses of Blair and Davy.

Black vomit varies greatly in abundance: sometimes being unobserved, even when *post-mortem* examination shows the stomach filled with it; at others being measured by the quart. Occurring generally during the last day of life, it may commence as long as forty-eight hours before dissolution. The vomiting, not usually difficult, is often spoken of as simple *gulping* or *pumping*.

When an abnormal state of the bowels has been noted, *constipation* has been the general rule. Ex-

ceptionally, cholera and diarrhœa have been observed. The most accurate account of the alvine dejections is by Doctor Blair. He says: "Ordinarily, the stools first observed were those produced by calomel and castor oil, early prescribed. These were bilious, and not worthy of particular description. Occasionally, in the early stages, a greater or less quantity of dark matter appeared in the evacuations —the first tangible morbid product of the disease, and highly diagnostic of the first stage. It is black, as after taking preparations of iron, or blackish brown, or gray and pultaceous." After cessation of these melanotic (hæmatoidin) stools, the dejections become of a dirty-gray color, abilious, liquid, and, on standing, deposit a sediment, revealing to the microscope crystals of uric acid and of the triple phosphate, properly belonging to the urine. Toward death, the discharges become scanty and mucous, green, olive, fawn colored, rusty, brown, black, or streaked—the latter being called *black vomit stools.* These redden litmus paper, all the others are alkaline. No unaltered blood globules need be looked for in these dejections.

To the eye and touch the abdomen presents nothing abnormal, excepting the well-known discoloration of the skin. This symptom, from which one of the old names of yellow fever, *typhus icterodes*, was taken, is not always present, even in fatal cases. As a rule, it appears in the latter half of the attack,

but it may appear among the earlier phenomena. It is apt to be first observed in the conjunctivæ and about the chin, extending subsequently to the chest, where the hue is often deeper than elsewhere, and to the body generally. The tint varies from a delicate straw color to a deep ocher. It is, no doubt, a true jaundice, and is intimately connected with a peculiar state of the liver, to be hereafter mentioned.

Epigastric pain, oppression, and tenderness are exceedingly frequent symptoms. Even when no complaint has been made—especially in the stage of prostration—very slight pressure on the epigastrium will cause pain, distress, or vomiting. Flatulence has been often observed to an extreme degree, constituting a very annoying symptom. In cases of unfavorable epidemic constitution, and toward the later stages, *hemorrhage* constitutes a very important phenomenon. It may occur from any mucous surface—from a recent blister, from any wound or puncture of the skin, as that made in venesection, from a leech or mosquito bite, or in cupping. A woman, whether the catamenia be due or not, scarcely ever fails to menstruate. The tongue and gums furnish the most frequent source of the bleeding, especially where ptyalism has unfortunately been produced.

Lawson observes, concerning sanguineous discharges, that if normal blood corpuscles appear in the flow, it is often a beneficial process, by the relief it affords to congestion. In the form of dissolved

hæmatine, without globules, it seems to be rather a secretion than a true hemorrhage, is often copious, always unmanageable, and almost of fatal import. Blood passed by stool, and free from fecal matter, though of good crassitude and color to the naked eye, is always found, under the microscope, with *all its corpuscles ruptured.*

Since the attention of medical men was called to the *state of the urine*, by Staff Surgeon Collins, of the British army, much valuable information has been acquired with regard to the kidneys and their secretion. We now know that *uræmia* constitutes one of the most important elements in the pathology of yellow fever. Doctor Blair, after observing eighteen hundred cases, states that "albumen appeared in the urine in every fatal case of normal duration." It appears on the second or third day generally, and may show itself within twenty-four hours. Rarely was its appearance deferred until the day of death, or the supervention of black vomit. In cases where the fever aborted, the urine was seldom albuminous. In a few it was noted during convalescence. Purging with croton oil seemed to make it later in showing itself. As in ordinary albuminuria, the phenomenon was not constant, occasionally disappearing for a day or two, to return. It ceased to exist, permanently, from the eleventh to the twentieth day, its disappearance being the indication for discharging the patient from the hospital. The color of the pre-

cipitated albumen is primrose or sulphur; never white, as in Bright's disease. Possibly this, too, is due to some form of hæmatoidin, as no bile was discovered by analysis.

In the urinary sediment, granular casts of the tubes were commonly found, mingled with disintegrated amorphous epithelium, in the early period from the bladder, later from the uriniferous tubes. Doctor Lawson observed that the chlorides commence to diminish with the appearance of albumen, and are nearly entirely absent when active tubular desquamation is at its height. They began to reappear about the seventh day, in favorable cases, and increased in abundance from day to day. It is proper to observe that, in repeated instances, Dr. Porcher found the urine free from albumen. Its presence was exceptional.

The urine is not usually abundant until the establishment of convalescence. "When the secretion was copious and transparent, even though dark colored and most highly coagulable, the struggle was hopefully maintained."—*Blair.*

Acid during the first stage, it habitually preserves this reaction until convalescence or admixture with bile, when it becomes alkaline. Its color is normal until the third day, when a sulphur, straw, or primrose tint is observed. This deepens, until it assumes a yellow or orange hue—sometimes, in large quantity, seeming even black. Globuline and casein,

creatine and creatinine have been noted by Dr. Lawson in his Jamaica experience. Urea is deficient, as Porcher's excellent observations have shown.

Suppression is commonly abrupt. Not even black vomit is a more fatal symptom. Hæmaturia is not often met with, and is not highly unfavorable, *per se*.

The occurring of *neuralgic* pains is mentioned as being among the early symptoms. These, as a rule, last through the fever, and are, in many instances, inexpressibly agonizing, causing the stoutest and bravest men to complain and groan. Another neurotic trouble, scarcely more supportable, is the unspeakable malaise under which many labor. Even while denying the existence of any discomfort, the patient will be incessantly occupied in changing his position in bed, in rising to go to the window or to walk the floor.

The *mental condition* is usually one of integrity. In the early stages, much apprehension is commonly felt as to the nature and issue of the disease. As soon, however, as the first or febrile stage has terminated, a most extraordinary indifference to life and its concerns is manifested. Even while persons were dying in their immediate vicinity with black vomit, patients have been known to amuse themselves by trials of dexterity, in seeing which one could most successfully squirt the fatal fluid at flies on the adjacent walls. Doctor Blair, perhaps correctly, attributes this psychological state to uræmic intoxication. The

analogy between yellow fever and cholera, in this respect, of indifference to the result, will be apparent to one familiar with the latter disease. Except shortly before death, *delirium* is not commonly seen. While sopor and stupor are not unfrequently met with, coma is not often encountered. The sleep is restless, dreamy, and unrefreshing.

The *expression of the face* has been dwelt on by authors; but, while acknowledging its peculiarity, it would serve but little useful purpose to state more than that the eyes are suffused, red, sometimes having a drunken look, and that hope, indifference, or despondency may be observed, according to the stage or especial nature of the case.

In yellow fever countries it is common to speak of *walking cases*. By this term is meant a very peculiar type of the disease, in which death occurs with scarcely any *feeling of illness*, and without symptoms such as have been described. To avoid unjust suspicions of malingering, it is necessary to be well aware of this insidious form. Louis mentions the case of Doctor Mathias, who died, after an illness of four or five days, without chill, fever, nausea, or vomiting. He experienced no other symptoms but severe pains in the calves of his legs, and urinary suppression. This latter indicated the severity of his case. Begging a friend to write a few letters from his dictation, he urged him to finish the last rapidly, that he might have time to sign it. Soon

after, unable to speak, he thanked his friend, with a sigh, and in a quarter of an hour was dead. Doctor John Wilson speaks of "cases like these, where I have ordered a man to do his duty, because I could not see *much the matter* with him. He continued to do duty, after a fashion, for nearly two days, when the eruption of black vomit gave irresistible and mortifying evidence that the man was no impostor."

It has been remarked that there is, in general, more or less marked diminution of muscular strength. In cases of hemorrhage, and during the second stage, (apyrexia,) a patient may be almost perfectly helpless from this debility. Cramps are not usually met with. Spasmodic action of the diaphragm, giving rise to hiccough, is by no means rare. With black vomit and ischuria, it belongs to the category of very bad symptoms.

Of the *type* of yellow fever, enough has been said to establish its difference from remittent, intermittent, or congestive fever, as these terms have been explained in the paper devoted to those affections. In some epidemics, occurring in malarious regions, the disease has presented elements of periodicity; but every one familiar with the pathology of miasmatic ailments knows how easily this peculiar feature may occur, as a simple epiphenomenon, having no essential connection with the main malady. Doctor Lewis, by analyzing twenty carefully-observed cases of yellow fever, concluded that the *first stage*, that of

febrile excitement, lasted twenty-two hours; the *second stage*, that of remission or of calm, of "deceiving tranquillity," (*Mosely*,) one hundred and twenty hours; that of collapse, fourteen hours. Of course, in different epidemics, these numbers will be found to vary materially.

Few diseases progress so rapidly and are of such short duration. Sometimes fatal cases occur within forty-eight hours, the great majority not being protracted beyond a week.

In mild cases, convalescence may be established as early as the third day. Some epidemics have been characterized by speedy and uninterrupted return to health, others by a slow and lingering process, extending to several weeks, even where the type of fever was benign. Although the symptoms subside on the fourth day, the patient is stripped of all his strength, and can neither sit up nor take exercise for five or six days.

Generally speaking, *relapses* are not to be dreaded, although some observers, in particular years and places, have mentioned them as being frequent.

Recovery may be expected to occur without sequelæ of serious nature.

Incubation may be said to have for its usual period about a week. It has been known to extend to twice that time.

As to *mortality* in yellow fever, the usual law of grave epidemics is observed. The largest proportion

of fatal cases occurs early in the visitation. Some years will be noted by the comparative rarity of deaths, others by sweeping devastation. "In Mobile, (1819,) out of a population of one thousand souls, more than one-half of whom were acclimated, four hundred and thirty died!"—*Lewis.*

After what has already been said, it will be useless to the practitioner to allude further to prognosis in general. Nor need the matter of differential diagnosis claim our further care.

In mild cases, occurring in regions where bilious remittent fever prevails, there will always be a likelihood of mistake, for a short time and among the early patients; but this source of error cannot long exist in epidemics. "An initiatory chill, of moderate duration and severity, immediately followed by intense pain in the head, back, and limbs; *redness and suffusion of the eyes;* moderate excitement of the circulation, and moderate heat of surface; anorexia; thirst; white tongue, with red tip and edges,—these febrile symptoms of the first stage continuing for a day or two, and then accompanied or followed by epigastric pain and distress; nausea and vomiting; restlessness and anxiety, often more or less paroxysmal; and, in from three to five days after the attack, by yellowness of the eyes and skin; vomiting of matter resembling coffee-grounds, held in a dark-colored fluid; very dark or black stools; coldness of the extremities; increasing and excessive restlessness,

with occasional hiccough, hemorrhages from different parts of the body, and suppression of urine; the mind, in many instances, remaining clear to the end, and death taking place in from five to seven days from the attack,—these phenomena, thus combined, and thus following each other, constitute a disease which it seems impossible to mistake for any other." —*Bartlett.*

Of the *pathological anatomy* of yellow fever much has been made known, while much still remains for future research.

Cadaveric rigidity is usually well marked. In general, the surface of the body and conjunctiva are yellow, the color being commonly most marked in the face and trunk. As epiphenomena, traces of inflammation may be met with in different parts of the body.

The *blood* has been more satisfactorily examined by Dr. Blair than by any other observer. He has, moreover, the merit of having made his observations in fluid taken from the patients during life. In the first stage, nothing abnormal was found, except an occasional admixture with bile. The alkaline reaction was always observed. Only in the last stages and *post-mortem* were changes observed. And yet, cases terminating fatally, after ordinary black vomit and hemorrhages, were numerous, in which no abnormal condition, save this bilious tinge, could be detected. On the other hand, certain observations showed great changes to have taken place in the cir-

culating fluid during the last stages. "Scarcely any fibrin," "power of fibrillation lost," "color dirty brown," "corpuscles altered and misshapen, with no tendency to form rouleaux, and with adherent granules," "great rapidity of decomposition," "no separation occurring in the coagulum." Finally, Dr. Blair concludes that the healthy condition of the blood depends upon the free action of the kidneys, a copious black vomit, and alkaline exhalations of the breath.

The *brain* shows no special pathological condition in its structure. Congestion, with occasional ecchymotic apoplectic extravasations, are not very uncommon.

The *stomach*, sometimes natural in appearance, has more frequently its mucous membrane discolored, mammelonated, thickened, and softened, with patches of ecchymosis; ulceration is very rare. Its contents vary according to circumstances.

In many cases there are analogous lesions of the mucous membrane of the intestines. These latter frequently contain the matter of black vomit, as is so often the case with the stomach itself. The œsophageal mucous membrane, as a rule, is found altered, especially by softening and by discoloration, and by loss of epithelium, the latter condition being probably due to the acrid matters vomited.

The *liver*, in fatal cases of yellow fever, as a rule, is in a state of acute fatty degeneration. This was first conclusively shown by Dr. Alonzo Clark, in 1852.

It is usual to say that it has the color of *café au lait*, that it is dry, not of necessity altered in size, and that it contains little or no bile. Some observers have spoken of large, dark-colored livers, yielding abundance of blood on section. These are exceptional, as Clark well states. In the one case, hyperæmia produces much hæmatoidin and a moderate amount of oil; in the other, much oil and little hæmatoidin. The *gall-bladder* may be empty or full. The cases are very exceptional in which normal bile is found in it. Light-colored mucus and blood have been met with.

Of the *kidneys*, Dr. Blair remarks: "In cases which I have seen inspected, after protracted illness in apparent convalescence, the bloody condition of these organs has passed away, and the hypertrophied cortex is of a dull ochery color. *I have never been able to detect oil globules in the kidney.* The congestion, during life, has only been signalized by albuminous urine. The pains complained of are lumbar. Occasionally I have noted the kidneys in an almost apoplectic state; and yet their function was scarcely interrupted. On the other hand, I have been disappointed in the amount of congestion, in cases of entire suppression. Further investigation is needed on these points. The bladder is often empty, and its mucous membrane may show marks of extreme congestion. Of the *spleen* and other abdominal organs, nothing constant or important has been observed."

The *heart* is, as a rule, soft and flabby. Dr. Riddell, of New Orleans, in examining nearly thirty cases, found "in general that the transverse striation of the muscular fibres was indistinct, in some instances nothing but a granular degeneration of the contents of the myolemma being recognized by the microscope."

Beyond such results as would follow, of necessity, from the state of the blood in the latter stages, and from the universal tendency to capillary congestion, the *lungs* present nothing worthy of note.

TREATMENT.

The treatment of yellow fever has varied very much, according to the theory of the practitioner and the nature of peculiar epidemics. Many physicians, encountering mild types, the normal tendency of which, without gross mismanagement, is to recovery, have systematically medicated their patients in some peculiar way. Attributing to drugs what was simply a part of the natural history of the disease, the particular therapeutical course pursued by them has been heralded to the world as the true and only one to be relied on.

Is there a possibility of carrying an *abortive* treatment? *Can yellow fever be cut short?* In the present condition of our knowledge, this question must be answered in the negative. Medical journals contain not a few contributions announcing the discovery of ectrotic remedies; but there are two obvious sources

of error in their reasoning. The first has already been alluded to above. The second consists in the fact that nearly all such observers have exercised their profession in localities subject to prevalence of bilious remittent fever.

Certain it is, that subsequent experience on their own part, or on that of the general profession, has failed to confirm the value of the supposed discovery in any single instance. We are without a specific plan for the *cure* of this most grave malady.

It is strictly a self-limited disease—to be managed, to be led, but not to be driven violently toward a favorable issue. At the present day, no wise man places reliance on mercury, on the lancet, on cinchona, or on the muriated tincture of iron as specific remedies. Appropriate to the treatment of certain conditions, and for the relief of certain symptoms, these therapeutical resources must no longer be regarded as systematic or indispensable in all cases.

Among the first necessities are to be reckoned cleanliness, good ventilation, quiet, and *good nursing*. In bad cases, where practicable, there should be two nurses, one for the night, the other for the day. Unless diarrhœa be present, the bowels should be effectually opened as soon as the patient comes under treatment. By some, ten or fifteen grains of calomel, followed by castor oil or a saline draught, is considered the best cathartic. By others, a drachm of calcined magnesia, assisted in its action by draughts

of lemonade, is preferred. No other purgation will be needed, unless exceptionally, to meet particular indications. Dr. Stone, of New Orleans, if the patient be seen early, advises fifteen grains or a scruple of quinine immediately. This may be followed by ten grains more in the course of twelve hours. Beyond this he would not go. He thinks the medicine, thus given, prolongs and promotes diaphoresis, and that "the patient is safe while this lasts."

During the febrile stage, cold affusion or cold sponging is grateful and refreshing. Affusion may be practiced, as recommended in remittent fevers. The violent neuralgic pains may be best relieved by dry cupping or by rubefacients, as sinapisms, chloroform, or the like. Thirst may be assuaged by cooling drinks, such as acidulated barley or tamarind water, lemonade, or a weak sweetened solution of cream of tartar.

During the second stage, *expectation* is demanded. Great care should be taken to preserve perfect rest of mind and body pending this period of calm. Strict watch should be kept that the patients do not *uncover their bodies or limbs*, while care is taken that no undue weight of bedclothes oppress or overheat them. The sick should never be moved by rough handling. When necessary to change their place in bed, a nurse should station himself on each side of it, and effect the desired end by lifting the under sheet, thus transporting the patient without touching him. This is

necessary to prevent uncovering, and on account of the exquisite muscular tenderness and liability to bruise any part to which strong pressure is applied.

For the thirst which sometimes exists, there is nothing more grateful or appropriate than cold carbonated water, pellets of ice, or the effervescing draught of our Pharmacopœia. If nourishment be demanded, veal, chicken, or beef broth is advisable.

Should collapse occur, or seem threatening, it is to be met by stimulation. Iced brandy-toddy, or mint-julep, judiciously given, will usually be taken with readiness, and easily retained, where the stomach is not utterly rebellious. For nourishment, nothing is better than the animal broths just mentioned. In case of failure to retain them, when administered by the mouth, we can often advantageously employ them by injection.

Among the most distressing symptoms are nausea and vomiting. Rest to the stomach; the use of small doses of morphine; of prussic acid; of creosote, one drop every hour or two; of solution of camphor in chloroform, (ounce for ounce,) in two-drop doses, every hour, given in mucilage; of acetate of lead; of carbonic acid; minim doses of muriatic or nitro-muriatic acid; rubefacients or epispastics to epigastrium; and finally, the endermic or hypodermic application of opium or its salts, are among the means best calculated to afford relief.

Many recommendations have been made as to the

proper treatment in black vomit. In this event, *let the stomach alone*, so far as ingesta are concerned. Digestion is checked, and probably absorption is impossible. The exceptional cases of recovery, after this symptom, are due to non-medicinal influences.

It would be useless to devote especial consideration to the subject of prophylaxis, after what has already been said concerning the etiology. The predisposing causes, and those which we call exciting, as far as we know, have been mentioned. Do what is possible to escape their influences.

Note.—With the exception of an epidemic of yellow fever which occurred at Hilton Head in the summer of 1862, the armies of the United States have not been attacked with this disease since the commencement of the rebellion. New Orleans was threatened in the fall of 1863, and a few cases occurred in the fleet lying there, but none on land. I can bear witness to the care taken by General Banks and Surgeon R. H. Alexander, U. S. Army Medical Director, to carry out all measures looking to the preservation of a good hygienic condition in the city.—W. A. H.

PNEUMONIA.

PNEUMONIA.

Of the diseases which the army surgeon must expect to encounter in the present unhappy contest, pneumonia is one of the most important. This disease has already occurred to a considerable extent among the troops on the Potomac and in the West; but it will, doubtless, prevail to a much greater extent during the months of winter and spring. It prevails habitually much more among the inhabitants of the Middle and Southern States than at the North. It will be more likely to occur among Northern soldiers in a Southern climate than among native or acclimated residents. Statistics show that it occurs much oftener among those who are exposed to the vicissitudes of the weather, than among those whose occupations involve confinement within doors; hence it may be expected to prevail especially among troops in active service. Not only the prevalence, but the gravity of this disease is greater in the Middle and Southern than in the Northern States. A larger ratio of deaths in the former than in the latter is to be expected. In sections in which the periodical fevers are rife, pneumonia is apt to be extremely

fatal. This is the uniform testimony of physicians practicing in malarious regions, especially at the South.

These considerations show sufficiently the importance of the subject of pneumonia, at this time, to the army surgeon. But others may be added. Not only has pneumonia been studied, within the last few years, with diligence and success, as regards its morbid anatomy, symptomatic phenomena, pathological character and laws, but perhaps on no other important inflammatory affection has clinical observation been brought to bear so fully and efficiently as regards the management. In the first place, abundant facts have been collected respecting its course when uninfluenced by active medication—the true point of departure for the satisfactory study of therapeutics, as applied to any disease. And, in the second place, data have been afforded for judging of the value of different methods of treatment. As a consequence, a considerable change has taken place in the opinions and practice of not a few members of the medical profession with respect to the management of pneumonia. Therapeutical measures which, but a few years ago, were generally regarded as essential to its successful treatment, are now by many deemed often needless and hurtful. On the other hand, measures formerly considered to be uncalled for and hazardous, are now thought to be highly important in certain cases. Believing that, after making due allowance

for a tendency to pass to opposite extremes, which characterizes the fluctuations of medical doctrines, a real and truly important progress has been made of late in practical views respecting this disease, it is not unreasonable to suppose that, of those who have been called by the present contest from civil to military practice, some may not have given much attention to the subject, and, therefore, adhere to views which, with our present knowledge, are not tenable. Many of the medical officers of the army have seen but little of the disease, in comparison with the opportunities for observation which will now be opened in their new sphere of action. Moreover, most of those who are entering upon military experience have seen but little of pneumonia as it will be presented to them in soldiers occupying the Middle and Southern States. These last-mentioned considerations, doubtless, have been in the minds of the members of the Sanitary Commission, at whose instance this report is submitted.

It is hardly necessary to say that the discussion of questions relating, directly or indirectly, to the management of pneumonia, would be here out of place. The purpose of this report is to premise a few propositions, embodying certain pathological facts, having obvious relations to the management of the disease; and then, with reference to the leading indications for treatment, and the employment of different therapeutical measures, to present, as concisely and com-

pactly as possible, the practical views which appear to the committee to be most consistent with our present knowledge of the disease, and with the results of clinical experience.

1. Ordinary pneumonia, uncomplicated and not extending over more than a single lobe, does not, *per se*, involve much if any danger to life. The truth of this statement has been shown by large collections of cases in which the disease has been allowed to pursue its course without medicinal treatment, or with only palliative remedies. A fatal termination, therefore, in such cases, must depend on circumstances incidental to the disease, or on injudicious interference. It is obvious that, when active measures of treatment are indicated in such cases, the indications are derived from the incidental circumstances more than the disease itself.

2. The disease is much more grave, and becomes dangerous to life, when it invades more than a lobe, affecting an entire lung, or, more rarely, portions of both lungs, (double pneumonia.) The greater proportion of these cases is one of the reasons of the greater fatality of pneumonia at the South. In many of these cases, however, recovery takes place, and the symptoms do not always denote great gravity or danger. A source of gravity in these cases, to which attention has not been sufficiently directed, is the large amount of exudation matter deposited in the lungs. In fatal cases, in which an entire lung is

solidified, the increased weight of the affected lung, due to the solidifying deposit, may be as high as four pounds. This large quantity of matter is, of course, withdrawn from the solid constituents of the blood.*

3. The complications of pneumonia account for the danger to life in certain cases. One of the most serious complications is pericarditis. This occurs oftener at the South than at the North. This complication does not render the termination necessarily fatal. Patients may recover even when, in addition to this complication, an entire lung is involved. A degree of pleurisy exceeding that generally coexisting with pneumonia, and attended by considerable effusion, (which is rare,) accounts for the danger in some cases. It may be remarked here, that the coexisting pleurisy is the source of acute pain in pneumonia. Pneumonia, without pleurisy, is attended with little or no pain. Intermitting fever and pneumonia may be associated—each affection serving to mask, to a greater or less extent, the other. This complication is attended with great danger, and calls for prompt and efficient measures of treatment addressed to the intermittent fever. In the intemperate, delirium tremens is apt to become developed, and prove a serious complication, claiming efficient treat-

* See Clinical Lecture, *New Orleans Medical Times*, March, 1861, and the *New York Medical Times*.

ment. Cholæmia, or jaundice, is occasionally an incidental event in pneumonia. It does not, however, denote an important hepatic complication, and does not call for active remedies designed to act upon the liver. The propriety of recognizing "bilious pneumonia" as a variety of the disease may fairly be questioned.

4. Pneumonia occurs as a complication, or secondary affection, in the course of other diseases. Its occurrence in rubeola is not unfrequent. It is apt to occur in the continued fevers, typhus and typhoid. It adds much to the danger in these diseases. An important distinction is involved in typhus or typhoid fever, complicated with pneumonia, as compared with the so-called typhoid pneumonia. In the one case, the primary disease is the continued fever, the pneumonia being developed secondarily; in the other case, the pneumonia is the primary disease, certain symptoms becoming developed which denote what is commonly known as the typhoid condition.

5. The general and local symptoms accompanying pneumonia, when primary and uncomplicated, differ widely in different cases, and in these differences have originated certain varieties of the disease generally recognized by authors. When accompanied by high febrile movement,—a full, hard pulse, and a hot skin,—it has been called sthenic and frank pneumonia. Examples of this variety are oftenest seen in young, robust subjects, residing in healthy rural

situations. When, on the other hand, the phenomena belonging to symptomatic fever are not present in a marked degree, the pulse and skin denoting diminished power of the circulation, the disease is said to be asthenic. In each of these varieties the local affection, so far as it can be appreciated by the physical signs during life, or by examinations after death, may be the same. It is an expression of a well-known pathological fact, applicable alike to this and other inflammatory affections, to say that, with a similar amount of inflammation, different cases differ extremely as regards the disturbance of the system. The system appears to tolerate differently the same affection in different cases. And it is obvious that the management must have reference to the condition of the system quite as much as, if not indeed much more than, to the local affection. In cases presenting passive delirium and adynamia, the disease is called typhoid pneumonia. Here, too, the gravity and danger relate not so much to the local affection as to the general condition; and here, also, the treatment is to be governed more by the general symptoms than by the degree or extent of the inflammation.

6. The rapidity with which the exudation takes place in pneumonia, sufficiently to solidify the affected portion of lung, is of importance with reference to treatment. Different cases differ in this regard; but it is not unusual to find the physical signs of complete or considerable solidification (bronchial respira-

tion and bronchophony) within twenty-four hours after the date of the attack, and frequently this occurs in the course of forty-eight hours. Hence, were it possible to prevent this result, it must be by therapeutical measures which act with a promptness commensurate with the rapidity of the exudation.

7. Other important facts relate to the removal of the exudation. It is removed chiefly or exclusively by absorption, not by expectoration. The source of the expectoration in pneumonia is mostly if not entirely from coexisting circumscribed bronchitis. This fact has an obvious bearing on the use of remedies called expectorants, or, on the other hand, on the use of remedies which are supposed to interfere with expectoration. It is well known that pneumonia may be completely latent so far as cough and expectoration are concerned. The removal of the exudation may go on with great rapidity, even when no active measures of treatment are employed. In this respect cases differ greatly. It is certain that, before the natural course of this disease had been observed, the more or less rapid disappearance of solidification, occurring naturally, was often attributed to remedies supposed to act as sorbefacients. The complete removal of the exudation, in favorable cases, leaving the pulmonary structure intact, is an important as well as highly interesting fact. The tendency to run into a chronic form, as is well known, does not belong to this disease. It is rare for it to eventuate in the

third stage, or the stage of purulent infiltration, even in fatal cases. Abscess and gangrene are also results extremely infrequent. With a few exceptions, it may be said that resolution of the affected lung is sure to take place if the life of the patient be sufficiently prolonged. This fact has a very important bearing on the indications for treatment.

8. In the majority of the cases in which pneumonia proves fatal, the mode of dying is by asthenia rather than by apnœa. The patient rarely dies in consequence of the extent to which the respiratory function is compromised. It is not unusual to observe complete solidification of an entire lung with very little embarrassment of breathing. The fatal termination is much oftener due to failure of the powers of life. This is true of the different varieties of the disease, and of cases in which the disease is complicated or uncomplicated.

The indications for treatment in cases of pneumonia must have regard to the stage of the disease. When patients are seen in the first stage, *i.e.* prior to solidification of the affected lobe, important objects of treatment, if attainable, doubtless are the limitation of the inflammation, the prevention of exudation, and the restriction of the local affection to the lobe first invaded; in other words, the arrest of the disease. Are these objects attainable? With our present knowledge, this question resolves itself into another, viz., Will the antiphlogistic method of treatment, so

called, of which blood-letting is the most prominent measure, control the disease? Clinical experience certainly warrants the assertion that this method of treatment cannot be relied upon for effecting the objects just named. If this method ever succeeds in arresting pneumonia, the chance of success in any case is too small to justify its employment whenever it comes into conflict with other indications; or, in other words, whenever it will be likely to do harm if it do not succeed. Abortive measures, other than those commonly known as antiphlogistic, do not require notice, and, indeed, there are none, at the present moment, before the profession.

Putting aside arrest of the disease as an object of treatment in the first stage, the inquiry arises, May not active measures, in this stage, so influence the disease as to diminish its intensity, and thereby the danger, aiding the patient to pass through it more safely and comfortably, if not more quickly, than if the measures were not employed; and will not blood-letting conduce to these desirable ends? A candid review of the discussions which have taken place within the last few years respecting blood-letting in pneumonia, together with the results of clinical experience, can hardly fail to lead to the conviction that, employed indiscriminately, it will do much more harm than good. This, it must be admitted, may be true, and yet blood-letting be useful in certain cases. Its usefulness is limited to cases characterized by high

febrile movement, the patients being robust or of a full habit, and, of course, the disease not advanced to the second stage, when a pound or more of solid matter has been withdrawn from the blood to constitute the solidifying deposit. The abstraction of blood, if the pulse be strong, the skin hot, and the pain severe, with more or less dyspnœa, will undoubtedly afford relief, and sometimes, perhaps, place the patient in a better condition than if no active treatment had been resorted to. But even in the cases to which blood-letting is to be restricted, if employed at all, may not other measures be substituted which will accomplish the same ends without the spoliative effects of that remedy? We think this question may generally be answered in the affirmative. Blood-letting in these cases is not so much a curative as a palliative remedy. It is addressed, not directly to the local affection, but to the symptomatic febrile movement, and can only influence the local affection indirectly, in so far as the latter is intensified by the former. Now, the febrile movement may be not less efficiently restrained by saline purgatives, and by the nauseant and arterial sedatives, of which antimony and the veratrum viride may be named as the most reliable. The salines deplete without the loss of the blood corpuscles, or spoliation, and the sedative remedies diminish the frequency and force of the heart's action. These remedies, then, may take the place of blood-letting, certainly in the great majority of the cases in which

this measure would be admissible if substitutes were not to be found.

Antimonial preparations and the veratrum viride are potent remedies which are only to be employed to meet certain indications. They may do much harm if injudiciously or indiscriminately employed. They are indicated in cases in which the pneumonia is said to be frank or sthenic. They are to be given with great circumspection when, from the previous health, the constitution of the patient, or other circumstances, danger is to be anticipated from failure of the vital powers. They are never to be carried to the extent of producing marked depressing effects. The benefit to be obtained from them can be secured without these effects. They are not given to influence the local affection directly, but only through their action upon the circulation. They are imperatively contraindicated whenever the action of the heart, as represented by the strength of the pulse, denotes a tendency to failure of the powers of life. Given, or persisted in, under these circumstances, they will contribute to the danger of death by asthenia.

Relief of the acute pleuritic pain which belongs, in some cases, to the first stage of pneumonia, is an object of treatment. Restraining the movements of the affected side, pain induces fatigue, from the increased frequency of the respirations, and conduces to suffering from dyspnœa. Local measures will do much

toward this object. A considerable number of dry cups is an efficient measure. Wet cupping should be limited to cases in which the loss of the blood abstracted by this mode will be well borne.

Stupes with water only, or with some stimulating application, such as the spirits of turpentine, often afford marked relief. The oiled muslin jacket contributes to comfort by keeping the surface of the chest moistened with perspiration, and, if a flannel covering be added, all the advantages of a poultice or the water-dressing are secured. It is hardly necessary to say that blisters are inadmissible, certainly in this stage. There need be no reluctance in prescribing opium in this stage, for the relief of pain. The value of opium for other objects will claim attention presently.

If the phenomena of intermittent fever are developed, quinia should be given promptly and in efficient doses. The paroxysms should be arrested as speedily as possible. The patient may be placed in great danger by their repetition. The existence of the pneumonia and the degree of symptomatic febrile movement in nowise conflict with this important indication; indeed, so far from conflicting with it, the sedative influence of full doses of quinia may be useful, aside from the arrest of the paroxysms. In a malarious region, or if the patient have been subject to attacks of intermittent fever, it is judicious to forestall the possible development of the latter affec-

tion by moderate doses of quinia. It is a good rule, in such cases, to commence at once with the use of this remedy, irrespective of the liability to the occurrence of intermittent paroxysms. The malarious cachexia impairs the power of resisting the disease; hence its greater fatality in malarious regions, even when uncomplicated with intermitting fever.

The indications which have reference to the second stage of pneumonia are now to be considered. And it is to be borne in mind that this stage occurs in the vast majority of cases, and often speedily follows the attack. The change, as regards the indications, renders it important to determine when the disease has passed into the second stage; in other words, when the solidification of the affected lobe has taken place. The physical signs of solidification (bronchial respiration and bronchophony) afford reliable evidence on this point. The absence of chlorides in the urine also may be relied on with considerable but not implicit confidence, that the process of exudation is going on.

In the second stage, so far as the local affection of the lobe primarily involved is concerned, all the mischief which, in the majority of cases, may be expected to occur, has already occurred. The only untoward events (exclusive of complications) which are to be apprehended are the invasion of other lobes, and possibly suppuration and gangrene. The probability of the invasion of another lobe cannot be determined,

and, if this were possible, the prevention does not lie within the scope of our resources. What, then, are the objects of management in the second stage of pneumonia?

It may be assumed that blood-letting is not indicated in the second stage. The nauseant and arterial sedatives may be indicated by the persistence of high febrile movement in certain cases; but they are to be employed with even greater circumspection than in the first stage, and they are not to be given for other objects than those already stated. In a large proportion of cases they are either uncalled for or contraindicated in this stage.

In order to answer the inquiry just made, let it be asked, What are the requirements for recovery in the second stage of pneumonia? So far as the local affection is concerned, the exudation is to be removed; in other words, resolution is to take place: and, as regards the general condition, the powers of life must be adequate to carry the patient through the processes of restoration. The objects of treatment must relate to these requirements. The question, then, is, What can be done to promote resolution of the local affection, and what to aid the powers of life to effect recovery?

First, as regards resolution of the local affection. Antimonial preparations have been considered to contribute to this object. Laennec, ascertaining by means of physical exploration the rapid disappearance of

solidification under large doses of tartar emetic, was led to extol this remedy. But at that time cases of pneumonia without any active treatment had not been observed. It is now certain that the solidification may disappear with great rapidity, not only under different remedies, but when no remedy is given. Laennec and others naturally enough mistook for the effects of medication the changes occurring in the natural course of the disease. With our present knowledge, preparations of antimony are not indicated for the object under consideration. Given for this object, when uncalled for or contraindicated by circumstances relating to the general condition, they are not merely superfluous, but hurtful remedies, the injury, of course, being proportionate to the extent to which they are given.

It is not long since physicians generally deemed it important to give mercury, with a view of promoting resolution, and to push this remedy to ptyalism. But clinical observation has sufficiently shown that absorption of the exuded matter goes on as well without as with mercurialization. There is no need, therefore, of incurring the depressing effects of this treatment. And if mercurialization be not needed, it is certainly not devoid of harm; for every active remedy is potent either for good or evil, and if not useful, it can hardly fail to be hurtful.*

* Of 64 cases of pneumonia treated recently, at one of the Army General Hospitals, with mercurials and antimonials, and

Blisters are still too often employed in pneumonia in order to hasten resolution. There is no evidence that they contribute to this object, and they are highly objectionable on account of the annoyance and irritation which they are likely to occasion. Moreover, they interfere with the daily examination of the chest, by means of which alone accurate information respecting the condition of the lung is to be obtained.

Remedies to promote expectoration are sometimes considered as important. This is probably based on the idea that the expectoration contributes to the removal of the solidifying exudation—an idea already stated to be erroneous. Clinical observation shows that resolution may go on with great rapidity without any expectoration. It is true that an accumulation in the bronchial tubes takes place in some cases, toward the close of life, and doubtless contributes to a fatal result; but the accumulation is due, under these circumstances, to a degree of asthenia, impairing the muscular power necessary for the acts of expectoration, and expectorants are not adequate to afford relief.

In short, it may fairly be doubted if, with our present knowledge, we are able to expedite resolution by

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of which the results were forwarded to the Surgeon-General's office, 32 died; while of 51 treated at another hospital with stimulants and quinine, but 4 died.—W. A. H.

any measures employed directly and specially for this object. There are grounds for believing that measures having reference to the general condition of the patient are the most efficient means of acting on the local affection.

Second. As regards measures having reference to the general condition of the patient. The most important of the principles of treatment in pneumonia fall under this head. Resolution of the local affection may take place more or less slowly, but it will take place if the patient do not succumb. The danger in severe cases is generally not from the amount and persistence of the solidification of lung, but from the failure of the vital powers before the resolution is accomplished. Pure pneumonia is as much a self-limited affection as the essential fevers; divested of complications and accidents, it runs a definite career, and ends in restoration, if life be sufficiently prolonged. The exceptions to this statement are the rare instances in which the affection runs into the purulent stage. In the majority of fatal cases, as already stated, death is attributable more to asthenia than to apnœa. These considerations, together with the results of clinical experience, enforce the importance of the supporting treatment in pneumonia.

To support the powers of life, is the leading general indication in the second stage of pneumonia. This indication, in urgency, varies much in different cases. In general terms, it is urgent in proportion

to the danger from asthenia. It should govern the treatment in those cases distinguished as asthenic, and whenever there are grounds for distrust of the adequateness of the vital powers to carry the patient safely through the disease. It is a serious mistake to defer supporting measures until the symptoms denote imminent danger from failure of the powers of life. If deferred until then, they will probably be too late. The observing and skillful practitioner will foresee and endeavor to forestall a degree of failure attended with imminent danger. The constitution of the patient, his previous health, and his habits, are to be taken into account in judging early of the ability to sustain the disease. Other things being equal, in a warm climate patients are less able to sustain it than in cold or temperate climates; supporting treatment, therefore, is oftener and earlier called for in the former than in the latter. The plantation negro at the South is less able to sustain it than the white man, and, consequently, is more likely to need support. In the varieties of the disease distinguished as asthenic and typhoid, the reliance for successful management must be on supporting measures. These views are the more to be impressed, because it is undoubtedly true that, until lately, the minds of medical men have been so much occupied with the means of subduing inflammation, as to overlook the fact that the means for this end not only often conflict with those which are more

important for recovery, but may be positively injurious, and even destructive to life. The attention has been directed too much to the disease, and too little to the patient. We have seen that we cannot expect to subdue the disease; we can only hope, in the first stage, to moderate its intensity. But not a little can be done, by judicious management, toward aiding the powers of life to carry the patient safely through the disease.

The supporting treatment embraces tonic remedies, alcoholic stimulants, and nutritious diet. Of tonic remedies, quinia is to be preferred. It is not indicated in mild cases; but, whenever there are grounds for anticipating undue depression of the powers of life, it may be given, and continued during the progress of the disease. The propriety of giving this remedy, in tonic doses, in a malarious region, as well as to patients who have had periodical fever, has been already mentioned in considering the treatment of the first stage. Under these circumstances, the continuance of the remedy during the second stage is not less appropriate.

Alcoholic stimulants form a very important part of the supporting treatment in this disease, as in all others, whenever the great object is to keep the patient alive until the disease has reached the end of its career and advanced into the stage of resolution. The principle is the same as in the essential fevers. And here, as in the management of the

essential fevers, alcoholic stimulants are indicated to an extent commensurate with the danger from failure of the vital powers. In pneumonia, as in typhus or typhoid fever, there is often a remarkable tolerance of alcohol; and the only guide, as regards quantity, is the effect as manifested by the symptoms. No abstract rules can be laid down, applicable to all cases; but careful observation must furnish the rule proper to each individual case. Here, too, as in the continued fevers, because alcoholic stimulants are vastly important in some cases, it is not to be inferred that they are invariably indicated, nor that they can never do harm; on the contrary, if pushed to an injudicious extreme, they are as potent for evil as they are potent for good when judiciously used.* The question may be asked, Under what circumstances is their use to be commenced? We may say that they are indicated always so soon as evidence appears of any tendency to failure of the powers of life. And of this the action of the heart, as represented by the pulse, is the best criterion. Feebleness, great frequency, and a pulse vibratory or thrilling, but compressible, denoting increased activity but diminished power of the ventricular contractions, —these are the characters which indicate supporting

* In view of a tendency, at the present time, to an excessive use of alcoholic stimulants, the committee desire to impress the importance of the exercise of proper discrimination and care in their use.

measures, of which alcoholic stimulants are an essential part. Given at first in small or moderate doses, the effect is to be watched, and the quantity increased in proportion to the urgency of the indication. The habits of the patient, as regards the use of alcoholic drinks, are, of course, to be taken into account. Whenever the question arises, in the management of a case, whether alcoholic stimulants are advisable or not, it should be borne in mind that to begin earlier than they are required is far preferable to subsequent delay; for, with proper care, they can be suspended without any injury having been done; but the time lost, by beginning too late, cannot be regained.

Alimentation is an essential part of the supporting treatment. It is not less important to *feed* pneumonias than to "feed fevers," or other diseases, whenever there is danger from failure of the vital powers. If this be considered as a bold assertion, it is believed the only reason is its novelty. It is not long since the idea of feeding fevers was equally bold, because equally novel. The statement that patients with pneumonia may safely be encouraged to take nutritious food during the whole course of the disease, is based on considerable experience. And this should enter into the treatment in proportion as the symptoms denote a tendency to asthenia. Animal essences, or soups, milk, and farinaceous substances should be combined to form the diet, thus securing a proper

variety of alimentary principles. The desires and taste of the patient may generally be trusted. The juice of fruits may be allowed.

It may be considered as superfluous to say that, when the supporting treatment is indicated, measures which conflict with this treatment are contraindicated. But custom has so long sanctioned the abuse of purgatives, that it may not be amiss to caution against their injudicious use in pneumonia. The usefulness of saline remedies of this class, in the first stage, has been alluded to. They are useful as means of depletion without spoliation. After the first stage, purgatives are only indicated when inconvenience arises from accumulation in the bowels; and the mildest measures suffice. Active cathartics depress the vital powers, and, in this way, do harm in proportion as supporting measures are called for.

The use of opium may be considered in connection with the supporting treatment. Opium may be given, as already stated, to relieve acute pain in the first stage. It may be given, also, to allay cough. But, aside from these objects, clinical observation shows this to be a most valuable remedy in the treatment of pneumonia. Given in full doses, in certain cases, it tranquilizes the system in a remarkable manner. The frequency of the pulse and respiration is sometimes notably diminished. Refreshing sleep is obtained. It appears to render the system tolerant of the local affection; if, indeed, it does not, in some

instances, induce a more speedy commencement of resolution than would otherwise have occurred. These statements are based on the employment of this remedy in a large number of recorded cases.* An objection to the use of opium, on the score of interference with expectoration, is already disposed of. Expectoration is of no importance with reference to the resolution of pneumonia. That opium does not retard the absorption of the exudation, is shown by the rapid disappearance of solidification in cases in which the remedy has been freely given. The cases to which opium is specially applicable are those in which the affection excites unusual disturbance of the system, manifested by restlessness, vigilance, typhoid delirium, an irritable pulse, etc. Apprehension of inducing cerebral trouble need not be felt, even when typhoid delirium be present; on the contrary, the good effect of the remedy is often manifested by a more rational condition.†

Pericarditis complicating pneumonia adds greatly to the gravity and danger. By perseverance in the judicious employment of supporting measures, we may hope to save lives which would otherwise have

* See Analysis of Cases, in Am. Journ. of Med. Sciences, No. for January, 1861.

† More or less delirium is not very infrequent, even in cases of pneumonia which do not present other symptoms denoting the typhoid condition, and is not in itself necessarily a symptom of grave import.

been lost. The writer of this paper has reported a case of pneumonia affecting the whole of the right lung, complicated with pericarditis, and eventuating in pulmonary abscess, in which recovery took place under vigorous and long-continued supporting treatment.* It may be added, that timely and efficient support probably affords the best security against suppuration, whether in the form of abscess or purulent infiltration, and also against the occurrence of gangrene, which, happily, is extremely rare.

Pneumonia occurring as a complication of the continued or eruptive fevers, calls for soothing and supporting measures. Depressing measures, such as blood-letting, antimonial preparations, and purgatives, are very rarely if ever admissible under these circumstances.

A few words respecting the management of convalescence. There is little or no tendency to relapse. It must be extremely rare for a patient convalescing to be prostrated by a second attack. There is no need, therefore, of extreme precautions on this score. Experience shows that a solid, substantial diet may be entered upon so soon as the patient is fairly on the road to recovery, and that the convalescence is more rapid than if the appetite be too much restrained. As a rule, ordinary wholesome, digestible

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* New Orleans Medical Reporter and Hospital Gazette, vol. for 1860.

articles of food may be allowed, when they are craved by the patient. Permitting the patient to begin to sit up, when he feels a desire to do so, will be found not to retard recovery, but, on the other hand, apparently to hasten the progress of resolution.

Finally, with regard to pneumonia, as well as other diseases which may endanger life, let it be borne in mind that, although it is the most important end of medical practice to prevent a fatal termination, this does not comprehend the whole aim of the physician even in cases which recover. If he cannot cut short or abridge the duration of a disease, the next best result is to conduct it to a favorable issue. But this is not all. A rapid convalescence and a complete restoration to health are other important objects. And, in seeking to determine the relative merits of different methods of treating a disease, we are not to be guided solely by a comparison of the ratio of mortality, but by comparing the condition of patients during convalescence and after recovery. As regards the disease under consideration, although the substitution of a soothing and supporting treatment for the active measures formerly in vogue has doubtless diminished the rate of mortality, yet the improvement is equally shown in the rapidity and completeness with which health is regained.

In concluding this report, the following propositions are submitted, embodying the practical views which have been presented respecting the management of pneumonia:—

1. Uncomplicated pneumonia, limited to one lobe, in general does not claim active treatment of any kind, simple palliative remedies and hygienic measures being alone required.

2. Blood-letting and other antiphlogistic measures, with a view of subduing the inflammation, are not warranted by a sufficient probability of success, and, if resorted to for this purpose, will be likely in many cases to do harm.

3. Blood-letting is useful, not by a direct effect on the local affection, but indirectly by diminishing the intensity of the symptomatic febrile movement. It is admissible only in cases characterized by intensity of the febrile movement, when the affection is said to be sthenic, and only in the first stage of the affection.

4. In the cases to which blood-letting, if employed at all, should be restricted, the good effects may generally be obtained by saline purgatives, together with sedative remedies, such as the preparations of antimony and the veratrum viride.

5. The remedies just named are indicated only in the cases referred to. Given in cases indiscriminately, and carried to an injudicious extent, they may do much harm. They should be used with great circumspection, and rarely after the first stage of the disease. It is never advisable to push them so far as to occasion distressing nausea or vomiting, and enfeeble the heart's action.

6. Acute pain, depending on coexisting pleurisy,

does not call for general blood-letting. Dry or wet cupping, fomentations, and stimulating applications to the chest are useful, and, if not effectual, opium may be given sufficiently to relieve this symptom. The oiled muslin jacket, to be worn during the disease, is to be recommended.

7. The combination of intermitting fever and pneumonia calls for the prompt use of quinia in sufficient doses to arrest as speedily as possible the paroxysmal affection. Small or moderate doses of this remedy should be given in malarious regions, and to patients who are subject to intermitting fever, in order to prevent the development of intermitting fever and to obviate the unfavorable influence of the malarious cachexia. The remedy should be continued during the progress of the disease.

8. Antimonial preparations, mercury, blisters, and expectorants are not called for with a view to promote resolution of the pulmonary affection. There are not sufficient grounds for the belief that they hasten the removal of the exudation, and, if not useful, they must be injurious. There are no remedies to be employed especially for this object.

9. In severe cases of pneumonia, after the disease has advanced to the second stage, the most important object of treatment generally is to support the powers of life, to obviate the tendency to death by asthenia, and to carry the patient safely through the disease.

10. The supporting treatment consists of tonic

remedies, alcoholic stimulants, and nutritious food. These are to be combined, in order to render the supporting treatment efficient.

11. Alcoholic stimulants may be given without fear of affecting unfavorably the local affection. They should be given so soon, at least, as the heart's action and other symptoms afford evidence of any failure of the vital powers. They are to be given more or less freely, according to the danger from asthenia, the degree of tolerance and the apparent effect. They are not to be given as a matter of course, but only when indicated, and the quantity given is to be determined by the exercise of care and judgment.

12. A supporting diet embraces the animal essences, milk, and farinaceous articles. There is no risk in encouraging the patient to take nutritious food at any time during the progress of the disease; and there is reason to believe that danger from exhaustion may be forestalled by alimentation, together with the early employment of tonic remedies and alcoholic stimulants.

13. Purgatives, after the first stage, are not indicated, save when there is inconvenience from fecal accumulation, and then the mildest remedies which will effect the object are to be preferred.

14. Opium, given not to relieve pain or allay cough, but to tranquilize, promote sleep, and render the system more tolerant of the local affection, is a valuable remedy in pneumonia. It is indicated by unusual dis-

turbance of the circulation and nervous system, and its good effect is shown by a marked improvement in all the symptoms. This remedy does not retard the resolution of the local affection. It conduces frequently to improvement as regards delirium.

15. Soothing and supporting measures are especially called for in cases of pneumonia distinguished as asthenic and typhoid, and when pneumonia occurs as a complication of the eruptive and continued fevers.

16. The occurrence of pericarditis as a complication is an additional reason for the supporting treatment.

17. In convalescence from pneumonia there is not much if any danger of relapse, and the recovery is more rapid if a substantial diet be allowed and the patient permitted early to sit up.

DYSENTERY.

DYSENTERY.

The experience of recent as well as remoter times shows that the two great causes of death in armies are typhus, with its allied forms of fever, and dysentery. It also proves that, when they are most fatal, all of these diseases arise from the neglect of well-established sanitary rules, and that their ravages are least destructive whenever an intelligent appreciation of their forms, grades, and complications governs their treatment. This is emphatically true of dysentery. "Camp dysentery" is far from being uniformly the same. It may vary in type as greatly as dysentery does in civil life, presenting all shades of difference, from a slight and transient bowel complaint, with scarcely any general symptoms, to a violent inflammatory affection, or a malignant and putrid fever. It is the object of this report to remind the army surgeon of these fundamental diversities of type, and of the very different methods of treatment which they render necessary. Appropriately to fulfill it, all that is essential in regard to the description, causation, treatment, and prevention of dysentery

must be reviewed as fully as the practical purpose of the paper will permit. In doing so we shall confine ourselves to those pathological facts which have a direct relation to the treatment and prevention of the disease, leaving entirely aside the more or less speculative discussions which the inquiry may suggest.

Morbid Anatomy.—On opening the abdomen after death by dysentery, the relative position of the intestinal folds is often altered; the colon is most apt to be displaced, its transverse portion occupying the pelvis; and invaginations of the large as well as of the small intestine are frequent. Sometimes the peritoneum is injected, and in very rare cases inflamed. Perforation of the bowel is extremely unusual. The contents of the colon are fecal and mucous in the first stage; but, later, consist of epithelium, a jelly-like exudation, false membrane, blood, and pus. The mucous membrane in the small intestine is generally unaltered; but in the large its color is of various shades, from a rosy red to a dark brown or even black, and is more or less softened in recent cases. Sometimes large fungous granulations occupy the whole area of the ulcerated surface. In some violently acute cases of certain epidemics there is a wide-spread exudation of false membrane, while the tissue beneath is more or less gangrenous or sloughing. But more commonly the characteristic lesion is chiefly displayed by the mucous follicles. In the earliest stage of the simple acute, and, later, in cases

of the subacute form, there is, along with a general redness and swelling of the mucous membrane, an enlargement of its follicles by the deposit within them of a grayish or yellowish granular matter, which, by its increase, appears to determine the ulceration of the follicles themselves, and of more or less of the surrounding mucous membrane and of the subjacent cellular and even the muscular coats of the intestine. During this process the connecting tissue grows thicker and more dense, as if to resist the advance of the ulcerative process. Between the follicles the mucous membrane may also be destroyed by the extension of ulceration from them, by primary softening, or, as already intimated, by gangrene. The first is the most usual manner. As a consequence, large portions of mucous membrane may be removed, leaving the cellular coat bare, or partially covered by islands of mucous membrane. On opening the bowel these are very apt to be mistaken for pseudo-membranous deposits, and the denuded cellular coat for the healthy mucous membrane. Owing to the manner in which the intestinal ulcers are formed in dysentery they have usually a circular shape, and often the edges are as sharp as if pieces had been cut from the mucous membrane with a punch. In healing, the smaller ulcers fill up from the bottom, while the edges advance inwardly, and gradually the cavity is obliterated; but it is doubtful if a true epithelial coating is ever formed anew. Larger ulcers contract

in healing, and form a tough fibroid cicatrix which has a puckered aspect.

The ulcers which have been described are always most numerous in the rectum, and also more perfectly formed there than in the upper portions of the large intestine. Indeed, it is evident, from an examination of cases fatal at different periods of the disease, that the ulcerative process begins at the lower part of the bowel and gradually advances upward. In the rectum it sometimes completely destroys the mucous membrane, while in the superior divisions of the colon the ulcers are fewer and less profound. They seldom exist in the small intestine unless in cases complicated with typhoid fever. The mesenteric glands are enlarged and softened, and sometimes contain pus.

In *chronic* dysentery the mucous membrane of the colon is generally very much thickened, and it is studded with ulcers in various stages of cicatrization, and presenting appearances depending upon the type of the disease. The simplest form is that in which the ulcerative process has been uncomplicated with exudation. Here the ulcers may be of regular shape, with rounded and thickened edges and a whitish surface; or their edges may, by their puckered aspect, denote a tendency to healing; or large and irregular ulcers may occupy the greater part of the circumference of the intestine, exposing the muscular coat by its hypertrophied fibers, a condition, indeed, which

may affect the whole extent of the rectum; or finally, at a more advanced stage still, the healing of extensive ulcers may occasionally produce a contraction or stricture of the bowel. In all of these cases abscesses in the cellular substance around the rectum are not uncommon.

The exudation which has been referred to as belonging to certain grave forms of acute dysentery may, if the disease is greatly prolonged, become closely adherent to the mucous membrane, and even acquire a vascular connection with it, so that the raw surface which it leaves, on being removed, presents the appearance of an ulcer. The false membrane itself is even susceptible of taking on the ulcerative process. It sometimes, also, assumes a fungous character, and projects above the surface of the surrounding membrane. In very chronic forms of the disease, melanotic deposits are met with in the mucous membrane around healed ulcers, and elsewhere; and in some cases the mesenteric glands are found to have undergone calcification. From this brief sketch of the lesions in dysentery it will be understood that although ulceration of the bowel is seldom absent on post-mortem examination, there is necessarily an inflammatory process which precedes the loss of substance. In some cases of very rapid death from the typhoid form of the disease, no ulceration has been detected, simply because time for its occurrence was wanting. Even the presence of blood in the stools

is an insufficient proof that ulcers of the intestine exist. The practical value of this statement becomes apparent when we consider how much the efficacy of an appropriate treatment must be increased, if it is applied in the forming stage of the disease, before any injury to the structure of the intestinal mucous membrane has taken place.

Definition and Forms of Dysentery.—Anatomically, dysentery is an inflammation of the follicles of the rectum and colon. Symptomatically, it is a febrile affection characterized by colicky abdominal pain, (tormina,) a constant and urgent desire to go to stool, (tenesmus,) and scanty mucous and bloody discharges. Nosologically, or according to its nature as a disease, it is a peculiar poisoning of the blood, manifested by fever and nervous disorder or depression, and a follicular inflammation of the large intestine. Of this last proposition a sufficient proof is the total want of proportion between the local lesions and the constitutional symptoms. The latter not only precede the former, but may even prove fatal before the lesion of the intestine has developed itself. According to this view, which is suggested especially by the epidemic form of the disease, dysentery is analogous to typhoid fever rather than to the intestinal irritation produced by acrid substances, and by piles, fistula, and similar local affections of the rectum; for as in typhoid fever of a grave type the general phenomena predominate, and death itself may occur

before any ulceration of Peyer's glands takes place, so in dysentery a fatal issue may be quite independent of intestinal changes, but present, on the other hand, all the evidences of blood poisoning. But while we must recognize in dysentery a specific nature demonstrated by the uniform occurrence of a characteristic lesion, whenever time is given for this to form, we must admit that the whole symptomatic livery or type of the disease is under the control of external circumstances; that under particular conditions it presents typhoid symptoms; in others bilious; in others, again, periodical phenomena, all of which may be superadded to or modify the essential characters of simple dysentery. It results from these facts that the essential phenomena of dysentery may become of far less importance than those which its accidental type impress upon it; that the latter may determine its degree of gravity, and even indicate a treatment directed not so much against the intestinal symptoms and presumed lesions, as against the diathesis or constitutional state which overlies them.

For convenient study dysentery may be divided into *Acute* and *Chronic*, and the acute form into *Mild*, *Sthenic*, *Bilious*, and *Malignant*. Of the *Periodical* variety a few words will also be said.

Mild Acute Dysentery.—The earliest symptoms of this affection are general malaise, soreness or pains in the back and limbs, debility, anorexia, and sometimes nausea and colic, and frequent calls to stool

without any evacuation. But in other cases, diarrhœa, which is generally slight, may exist for several days before the more characteristic bowel complaint, and be itself not unfrequently preceded by constipation. The calls to stool become, however, more frequent, and the discharges more scanty; they are immediately preceded by borborygmi and colicky pains in the abdomen, and accompanied by a sense of weight in the perineum and anus, a painful straining or bearing down, and the passage of small quantities of fecal matter mixed with jelly-like mucus, tinged with blood, diffused or in streaks or small clots, and scalding the anus in its passage. Sometimes pure blood is discharged, particularly by persons subject to piles. The number of such stools varies from six or twelve to twenty-four every day. The abdomen is not usually tender, nor is the colic or the bearing down very severe. The heat of skin is moderate or scarcely perceptible; the pulse slightly quickened; the tongue whitish, but moist; the appetite may be dull, but is not always lost, and the thirst is moderate; but tormina and tenesmus are excited by all kinds of food except the very mildest. In this form an attack of dysentery is of one or two weeks' duration, and terminates by the gradual return of the alvine discharges to their feculent condition, and a copious lateritious deposit in the urine. Simultaneously a full perspiration is sometimes observed as a critical phenomenon.

Sthenic Dysentery.—This form of the disease is distinguished by the full development and sthenic nature of the characteristic symptoms, which are eminently those of an inflammation of the rectum and colon. It generally commences with a well-marked chill, followed by a hot skin and a full and frequent pulse. More rarely than in the milder form, is it preceded by simple diarrhœa, or, if this occurs, it is more vehement, and is accompanied with nausea and even vomiting. With the reaction from the chill the face becomes flushed, especially on the cheeks, and the eyes are injected, while the frequent and tense pulse, the severe headache, and urgent thirst denote a high grade of fever. Colic of a very severe description, and almost unremitting, is experienced; and the abdomen, which is often tense and hard, but not necessarily distended, is very sensitive to pressure, especially in the left iliac region. Severe contusive or aching pain is also felt in the loins, extending to the thighs. But the chief cause of suffering is tenesmus, which in many epidemics is almost uninterrupted, and becomes excruciating while the patient strains at stool. It is, in some cases, nearly constant, even when nothing is voided, and the expulsive efforts bring on a protrusion of the mucous membrane of the rectum. The sensation is sometimes said to be as if a burning iron were thrust into the bowel. It is important to be noticed that the extreme degree of pain here described is by no means an unfavorable

symptom, but may perhaps be rather considered as a measure of the patient's power of resistance. The opposite condition, or complete inertia, is indicative of a much more serious danger. The quantity of matters expelled is in an inverse ratio to the frequency and the violence of the expulsive efforts, particularly at the height of the disease. Near its commencement profuse discharges of blood may take place, which, indeed, afford some relief; but later, the stools consist of blood mingled with dense stringy mucus, or with the fibrinous products of inflammation. These assume the form of shreds of false membrane, or of masses resembling suet, more or less intimately associated with blood. Yet even in this variety of the disease, blood is not always nor in large quantities found in the dejections, which are sometimes almost suppressed, and in other cases have a lumpy appearance resembling imperfectly-cooked gruel. This is the form in which the fibrinous exudation is most frequently discharged. As the disease advances, the stools have a fetid, sickening, or cadaverous odor, become more and more frequent, and at last are passed involuntarily, while the anus becomes exquisitely tender, and is surrounded by inflammatory redness.

In some epidemics such stools are at times mixed, or alternate with others which are more or less green and frothy, particularly on the surface, and have been compared to the scum which is seen floating

upon stagnant water. The number of the stools does not always gradually decline, but often they almost entirely cease, and, after an interval, are renewed with a temporarily increased frequency. But in general this interval becomes longer as convalescence approaches.

Meanwhile there is extreme irritation of the bladder, and the scanty and high-colored urine scalds in its passage through the urethra. The thirst is intense, but all liquids, even the coldest, are apt to be rejected by the stomach, and to produce renewed paroxysms of tormina and tenesmus. Often a severe burning pain in the abdomen is complained of. At first the pulse is full as well as frequent, but rapidly assumes a tense, wiry, concentrated character. The voice is interrupted and weak. The tongue is sodden and thickly coated in the early stage of some cases, but afterward is more frequently contracted, sharp, and very red, and gradually becomes dry, rough, fissured, brown, or blackish, in unfavorable cases; but this condition is far from being constant; the features are sunken and sharp, the nostrils and lips become fuliginous, and a dark-red blush appears over the cheek-bones. The skin of the whole body is harsh and dry. These symptoms are most marked in cases approaching a fatal termination, and, independently of any epidemic influence, may even merge into others which are characteristic of the adynamic or malignant form.

The duration of severe acute dysentery may be stated at two to three weeks.

Bilious Dysentery.—This form of dysentery should not be confounded with that in which the liver becomes secondarily affected with inflammation, tending to the production of abscess. The latter is almost exclusively met with in warm climates, and the fullest descriptions of it have been furnished by English practitioners in India, and French army surgeons in Algeria. But bilious dysentery, properly so called, is also frequently observed in temperate climates, and often, but by no means exclusively, in malarious districts. Its predominant characters are gastric and hepatic disturbance and an excessive secretion of bile. It seldom assumes a distinct inflammatory and sthenic type, but, on the contrary, has a decided tendency to produce debility and exhaustion.

The invasion of bilious dysentery is apt to be marked by general coldness and extreme prostration, rather than by a rigor, properly so called. The sense of weakness is particularly referred to the back and loins. At the same time there is severe pain in the abdomen, with a bitter taste in the mouth, yellowish tongue, constant nausea and efforts at vomiting, with copious discharges of bile from the stomach. There is generally pain in the head, with vertigo, and irregular and transient chills, the pulse meanwhile being in some cases full, and in others weak and thready. At first there is occasionally constipation, but more usually frequent and bilious stools, which are apt to continue for several days, when they become glairy

and bloody; or blood may be mixed with the dejections from the beginning, and predominate in them more and more as the disease advances. These various degrees and kinds of admixture cause the color of the discharges to vary from pale to almost black. There is a peculiar tendency, also, to gaseous distention of the bowels, and the evacuated matters are extremely fetid, exhaling a putrid or cadaverous smell. This circumstance may be owing in part to the large quantity of altered blood which the bowels contain. The stools are very frequent, and may amount to one or two hundred in twenty-four hours, while thirty or forty are passed even in the mildest cases. As might be expected from this circumstance, tenesmus is sometimes constant and very distressing, and the urine scalds in passing. But neither of these symptoms is so frequent or severe as in the purely inflammatory form of dysentery. Intense thirst may be noticed as a prominent symptom. In the worst cases, the tormina and tenesmus are constant, even in the short intervals between the evacuations, and even when the latter are abundant; but cessation of pain, excessive meteorism, and hiccough are among the worst signs, to which may be added paralysis of the lower extremities, of the mouth, tongue, or organs of deglutition. The duration of bilious dysentery is less than that of the inflammatory form, a favorable termination frequently occurring within a week in mild cases, and within a fortnight in the more severe. On

the other hand, it may terminate fatally at a period as early as the shorter, or as late as the longer period, or even later, if an improper plan of treatment has been pursued in cases which tend naturally to a cure.

Malignant or Typhoid Dysentery.— The typhoid state is one which many acute febrile diseases assume, sometimes under inscrutable atmospheric influences, and sometimes under debilitating, exhausting, and depressing causes, both physical and mental, and such as abound in camps, on board ships, and in other places where human beings are crowded together. It seems not improbable that typhus fever (petechial typhus) is nothing more than this state in its simplicity, and carried to its extreme degree; for, in it no lesion of the solids can be found to explain its symptoms, except a tendency to disintegration, which depends upon a previous disorder of the blood. But in all other diseases which present more or less analogous phenomena, there is also a local structural lesion, which accounts for their specific characters and distinguishes them from typhus fever. Typhoid fever is a blood disease, with dothinenteritis, and a more or less marked predominance of the typhoid state; and typhoid pneumonia an inflammation of the lung, with the typhoid state superadded, and exerting a controlling influence on the local and general phenomena, and on the tendency of the local disease. The eruptive fevers are very prone to assume this state, because, it may be presumed, in them, as in typhoid

fever, the primary morbid change is in the blood itself. It is reasonable to suppose that, if external circumstances favor, they will become complicated with that alteration of the circulating fluid which is characteristic of typhus fever, and that they will be more apt to become so than affections whose primary seat is in the solid organs.

Now, observation teaches us that bowel complaints are more prevalent, as a general rule, than any other diseases in camps, barracks, hospitals, etc., because in them the direct exciting causes of these complaints abound; from observation we also learn that in such places, under circumstances peculiarly unfavorable to a vigorous performance of the functions, all diseases, and those especially which affect the whole economy, tend to assume the typhoid type; and, finally, we know that when these latter causes are greatly in excess, cases of pure typhus prevail. In other words, the intensity of the cause becomes so great that, instead of merely displaying its action upon those already sick, and furnishing a typical physiognomy to other affections, the typhous poison is powerful enough to generate its peculiar phenomena in persons merely enfeebled, but not yet specifically diseased. Consequently, there have been epidemics of diarrhœa, dysentery, pneumonia, intermittent fever, typhoid fever, and typhus, simultaneously in the same camp, hospital, or town, in which it seemed difficult to determine which was the original, and

which the superadded affection, so intermingled did the periodical and the typhous phenomena become with one another, and with those which belonged to the local lesions of several of the affections. An attentive analysis will, however, generally reveal which of the symptoms of any given case are owing to a local and material morbid change, and which must be attributed to the general blood or nerve disease. Or, if the type affection predominates in all the phenomena occasioned by the local disorder, it will still be possible to distinguish both the one and the other as we do the physical properties of a substance through a coating of varnish that invests it.

Typhoid dysentery is, then, in its simplest form, a variety of dysentery in which the phenomena of the typhoid state are superadded to those which are characteristic of dysentery. To this alone the following description applies. The more complex cases will be alluded to under the head of *Complications*.

In the great majority of cases diarrhœa precedes the proper dysenteric symptoms for some time, particularly among those who have been subjected to the influence of debilitating causes. When these have been in operation for a considerable time, the patient rapidly acquires a cachectic appearance upon the supervention of the dysenteric symptoms proper, if not before, the skin becoming muddy and pale, or mottled also with ecchymoses, the hands and feet œdematous, and the countenance sunken and listless.

In whatever degree these phenomena present themselves, the dysenteric affection is accompanied at its very outset with extreme, and often sudden, prostration, oppression at the epigastrium, and a rapid increase of the evacuations. At first the mind is clear, or, if delirium is present, it is usually of the tranquil sort, but in exceptional cases is maniacal. More generally the expression is stolid, vacant, careless, or apparently thoughtful; questions are answered but slowly, and there is no real delirium until the approach of death. In some cases, however, there is incessant agitation, change of posture in bed, complaint of the weight of the bedclothes, or of burning heat in the abdomen while the surface of the body is quite cool to the touch; or the patient curls himself up in the middle of his bed and refuses to be disturbed.

The voice is very faint, and swallowing difficult, and sometimes there is vomiting, not only of liquids that have been taken, but even of blood. Retching is very frequent, or a movement between that and hiccough, and may be excited by anything swallowed, even by a few drops of water. Upon pressure, the abdomen is sometimes complained of, particularly at its lower part; but although spontaneous pain is occasionally very severe, such is not frequently the case. The stools vary in number and quality. Sometimes they are few, sometimes almost constant; they are accompanied occasionally with excruciating tenesmus,

but are often discharged without either effort or pain. They are most frequent at night, and are excited by swallowing food. Their qualities are extremely various. Often brown and mixed with mucus, or even scybalous, or watery and tinged with blood, or apparently formed entirely of decomposed blood, they are in some cases grayish-white or chalky looking, or sanious, and exhale a horribly sickening cadaverous odor. These characters may vary in successive evacuations, and, particularly, stools containing the products of inflammation may alternate with others of a more or less fecal character.

The urine is generally scanty and irritating, and occasions strangury and scalding in the urethra, and in some cases with a fatal tendency it is altogether suppressed. It may assume a brown color, due probably to dissolved blood globules; and this is a grave indication. The same remark applies to a fetid odor exhaled by the urine, the breath, sputa, or perspiration; to a persistently bad, putrid, or saltish taste in the mouth; to great and craving thirst, or a sense of dryness in the mouth, when the tongue is moist, and to clamorous demand for drink in spite of its rendering the stools more frequent.

In general the skin is dry and scaly, but it may also have a cold and sticky feel; and the nose, hands, and feet are often cold. Even when general perspiration occurs, it is seldom critical. Petechiæ and vibices may form, particularly upon the legs and arms;

pustules, blebs, and miliary vesicles are not unusual, and may be followed by ulcers. The gums may be swollen, dusky red, or bleeding; and bleeding from the nose is not unusual. The pulse is feeble, but its natural frequency is often unchanged materially. If it much exceed one hundred per minute, the accompanying prostration is very great, or some complication (peritonitis usually) is forming. With the progress of the disease the hiccough, dysphagia, and debility increase; the abdomen often swells, and the stools are passed involuntarily and unconsciously; the tongue becomes incrusted, and the teeth are covered with dark and sometimes bloody sordes; gangrene may attack the feet or parts subjected to pressure; and death takes place by exhaustion. If the disease is fatal at an earlier stage, coma or delirium may attend its close, which is sometimes hastened by erysipelas.

Complications.—The most important general diseases which complicate dysentery, especially in its epidemic form, are *typhus and typhoid fever, intermittent fever, and scurvy.*

In reference to the two *forms of fever* first mentioned, little need be added to what has already been said, except that they more or less obscure the dysenteric symptoms during their continuance; but if the patient survives their decline, those symptoms reappear, and by their peculiar gravity rapidly exhaust the powers of life. In cases of dysentery, to

which one of the other diseases has been superadded, the intestinal lesions do not appear to have their progress suspended, although the diarrhœa may have ceased or become very slight as well as the tenesmus. After life has been rapidly extinguished, with exhaustion by frequent, thin, watery, serous, sanious, or bloody stools of an excessively fetid character, and the other indications of a devitalized blood and disintegrated solids, the mucous membrane of the large intestine is often extensively and deeply ulcerated, dark and even gangrenous, and sometimes there are found, besides, in the small intestine, the characteristic lesions of typhoid fever. But, we repeat it, the clinical history of such cases is often extremely obscure.

Epidemics of dysentery in malarious districts are, in common with many other affections with a local lesion, more or less influenced by the cause of *periodical fevers*. Not only do these predispose to attacks of the former disease, but it would seem that the predisposing causes of the one, such as cold, dampness, and fatigue, tend to develop the other. Not unfrequently an attack of dysentery suspends the intermittent paroxysms, which return upon its decline. In some cases the two affections occur simultaneously, and the dysenteric symptoms present periodical exacerbations; in others the phenomena of the paroxysms of intermittent fevers are dysenteric, the intermission being free from the symptoms

of both affections. The latter form is by far the least frequent.

The complication of *scurvy* usually precedes the development of the dysenteric affection, and accompanies or is preceded by the diarrhœa, which has been referred to as the ordinary antecedent of camp dysentery. Its proper symptoms are paleness, emaciation, and extreme lassitude or aversion to labor, dejection of spirits, pains in the loins and limbs, spongy and bleeding gums, and purplish and livid specks or spots or indolent ulcers upon the legs, which also become œdematous and cold, and stiff. There is at the same time an aversion or indifference to food, and the pulse is small and feeble. If diarrhœa exists, as it usually does, the stools are by turns bilious, watery, or bloody, and sometimes consist of pure blood. Upon the supervention of dysentery, with its abdominal pains, tenesmus, and more frequent stools, the scorbutic symptoms proper, if slight, are not always aggravated, but are rendered more intractable; but if already well developed, they coincide with those of the dysentery itself, and the union of the two morbid processes rapidly undermines the strength by completely subverting the reparative functions of the economy. Generally the complex disease then assumes the form of typhoid dysentery, with an aggravation of all the symptoms which depend upon a dissolution of the blood.

Among the other complications, and which need

not here be described, because they do not form any proper union with the dysenteric symptoms, are *rheumatism, diphtheria, and parotitis.* The first may alternate with dysentery, or rather be suspended during the progress of the bowel affection; the second is a grave occurrence in all the forms of the disease, but especially in the typhoid, which it is most apt to complicate; and the last, which most frequently occurs during the decline of the attack, is least dangerous when it terminates in suppuration, and most so when it suddenly or very rapidly subsides.

Abscess of the liver is a frequent complication of dysentery in warm climates, and particularly among drunkards. In this country, even in the Southern States, it appears to be rarely met with.

Convalescence—Chronic Dysentery.—Dysentery is peculiarly subject to relapses, even after its mildest attacks, unless great care be taken of the patient's regimen. The simplest form, indeed, if not very improperly treated, is followed by a speedy return to health, but even slight errors of diet will occasion abdominal pain and diarrhœa, and perhaps some tenesmus and diarrhœa, and sometimes loss of power in the sphincter ani. A tendency to sweating, particularly at night, is frequent; the hair is apt to fall out; boils may form in various parts of the body; and abscesses about the anus and hemorrhoids are not uncommon. If the patient remains in the place where the disease was contracted, the cure of severe

dysentery is slow and difficult even under the most appropriate regimen, and without this a relapse may occur notwithstanding his removal to a more salubrious locality. The intestinal ulcers do not completely heal, and the discharges are more or less constantly mucous, serous, purulent, or bloody; the food passes rapidly through the bowels and is often discharged undigested; emaciation is persistent and extreme, and accompanied with hectic symptoms; and occasionally perforation of the bowel near the sigmoid flexure of the colon takes place. More frequently thickening affects the coats of the bowel in this region, forming a stricture. These are the prominent phenomena of *chronic dysentery.*

Duration.—Simple acute dysentery of a mild type lasts from one to two weeks before complete convalescence is established, and the severer inflammatory forms, if uncomplicated, run their course in from two to three weeks. But these are only approximative terms. The graver and complicated varieties of the disease may terminate fatally within a few days, and the least severe, if improperly treated, or in unfavorable circumstances, may be indefinitely prolonged, and become chronic.

Diagnosis.—As stated in the definition, tormina, tenesmus, bloody stools, and fever form a group of symptoms peculiar to dysentery. It may be added that the constitutional depression is greater in dysentery than in any affection which casually resembles

it. Thus, a person subjected to bleeding piles may be attacked with colic, tenesmus, and a discharge of blood from the rectum. But there is wanting any marked derangement of the nervous system, of the circulation, or of the organs of primary digestion; besides which the history of the attack will reveal its special cause. The same remark is applicable to cases in which irritant substances, food, or poisons have occasioned similar symptoms.

Prognosis. — The danger of dysentery depends chiefly upon its type. The mild form always terminates favorably under judicious treatment; the sthenic, and the bilious form, when simple, are those in which the method of treatment employed exerts the greatest influence on the rate of mortality which they occasion, and in which, therefore, the largest field is open for medical skill. Typhoid dysentery is the least amenable to treatment, and is the form to which the greatest ravages are attributable, as many as two-thirds of those attacked by it falling victims in certain epidemics. The mortality in proportion to the number attacked is always greatest at the commencement of an epidemic, as if the morbid cause were then most virulent; but the aggregate mortality continues to increase for some time in proportion to the number of persons attacked, and then as gradually declines with the extent as well as the virulence of the disease. The rate of mortality is always greater among those who remain in the place

where an epidemic first breaks out, than among either those already sick or those who are subsequently attacked, and who are removed to a more salubrious situation. This remark is founded upon the experience of all armies which have been visited by the disease. We may add that, other things being equal, it is more fatal in ordinary hospitals and barracks than in the better ventilated and less crowded field hospitals. It need scarcely be remarked that a previously good state of health is an important ground of a favorable prognosis, and that ill health, exhaustion by fatigue, scanty or innutritious food, or wounds are equally unfavorable in their influence. Malarious influences aggravate the mortality in epidemics of dysentery, both by their previously debilitating operation, and by their directly complicating the graver disease.

The special ground of a favorable prognosis is simply the original slightness or the regular subsidence of the characteristic symptoms. Of unfavorable indications, the violence of the sthenic symptoms in general may be mentioned, but more particularly the sudden or rapid decline of these symptoms, with a corresponding exhaustion of power. In the more or less typhoid cases, whether those originally having such a character or acquiring it in the progress of the disease, the following may be regarded as indications of danger: very frequent, fetid stools, resembling the washings of raw flesh, or dark and gangrenous in

their odor; the sudden cessation of abdominal pain; repeated vomiting or hiccough, and paralysis of the sphincter ani; suppression of urine; dysphagia, a dark, dry tongue, and aphthæ of the mouth; coldness of the extremities, the nose, or ears; petechiæ and vibices upon the skin; a dull and leaden countenance, and muttering delirium, weakness of the voice, complete aphonia, and paralysis of the lower limbs.

Causes. *Climate, Seasons, etc.*—Almost all writers agree in stating that dysentery is much more common and fatal in hot than in cold climates, and doubtless this statement is true, particularly in regard to the endemic disease. But it is nevertheless true that the prevalence of the disease in temperate climates is so great, at times, that of fifty-four notable epidemics of dysentery, which are recorded as having prevailed in Europe and this country, all but eight occurred in localities where the winters are cold and the summers of moderate temperature. From the equator to the arctic regions, there is no region where dysentery has not assumed the form of a destructive epidemic; and if fewer records of its ravages in hot climates exist, perhaps it is because the inhabitants are not accustomed to give their medical experience a place in their scanty literature.

The passage from summer to autumn is the season when dysentery is most prevalent. Of fifty recorded epidemics, thirty-six occurred at this period of the year. The most evident conditions for its generation

are hot days and cool nights. It has been found to occur when these were apparently the only morbid influences; but frequently another atmospheric condition peculiar to that season of the year exists simultaneously, viz., moisture in the form of exhalations from the ground, or more commonly the precipitation of water from the air by its contact with the colder earth, or with the surface of rivers, ponds, etc.; in other words, cold fogs. By them the perspiration excited by the day's heat is suddenly checked, and the discharge of the effete results of the decomposition from the skin, which the heat doubtless renders unusually active, abruptly ceases, the force of the recoil falls upon the organ which at the end of the summer is weakest, and probably finds an exit through the specific channels, the glands of the rectum and colon, which are the primary seat of organic change in dysentery. In all epidemics of dysentery occurring at the period here referred to, the disease begins to decline on the nearer approach of cold weather, and generally ceases to prevail by the month of November.

The frequent occurrence of dysentery in the autumn, and in localities where periodical fevers prevail, as well as the occasional union or alternation of the two affections in the same person, has lent some color to the opinion that both forms of disease are due to the same poison or malaria. But if malaria is regarded as a simple agent, the doctrine is not only

improbable, but incredible. On the other hand, considering marsh miasm as a compound in which a specific poison fitted for generating periodical fevers is associated with the peculiar products of vegetable decomposition, their joint agency in the production of the two diseases becomes readily explicable. It is very certain that epidemic dysentery often exists where the fevers in question are unknown, but where the atmosphere is loaded with the exhalations of decomposing animal and vegetable substances; and on the other hand, that these fevers prevail quite independently of dysentery in malarious regions. Such facts are quite inconsistent with the hypothesis of a single morbid poison being the efficient cause of both diseases. It is further to be considered that miasmatic fevers induce a state of debility and impoverishment of the blood which must necessarily promote and intensify the operation of all the direct exciting causes of dysentery, and particularly of crude and unwholesome food and foul air; and consequently that, such conditions favoring, dysentery will be apt to prevail along with periodical fevers in camps and barracks, and similar aggregations of men, when sufficient attention is not paid to the cleanliness and ventilation of the tents, chambers, etc.

But, independently of any such predisposing cause as marsh miasm, the condition of large bodies of men may be impaired by other agencies, so as to render dysentery epidemic among them. To these its origin

may be traced at seasons of the year when the cause in question does not operate, *e.g.* in midwinter. It is then, especially, that a neglect of hygienic measures is attended with the most fatal results; when the inclemency of the weather, prompting an effort to economize fuel, or to dispense with it, induces the poorer classes of citizens to shut out the air, as perfectly as possible, from their ill-built dwellings; and soldiers, crowded in tents, to supply, by their animal heat, the warmth which they require. They forget, or do not know, that every moment, they are generating a poison which contaminates the atmosphere, and probably clings to every fixed article within the dwelling, and, sooner or later, prostrates them as victims to typhus or to dysentery, or to both combined in one disease. It is a remarkable fact that the only place, in northern latitudes, where cholera raged as an epidemic in winter, was St. Petersburg—a city in which all the houses remain hermetically sealed during the cold season, and are heated by stoves in such a manner as almost entirely to prevent a renewal of the air. The history of typhoid dysentery is equally instructive, for it has always prevailed in crowded ships, and especially slavers; in prisons, barracks, besieged places, and camps, where men were crowded together, the air was imperfectly renewed, and the exhalations and excretions were allowed to mix with the atmosphere, and poison it; and when to these influences were added, as more direct and exciting

causes, inclement weather, excessive fatigue, depressing emotions, intemperance, and insufficient or unwholesome food, and water either naturally impure, or rendered so by holding decaying matters in suspension. So influential does the last-named cause become, even in ordinary civil life, that, as it has been shown in England, the population in the districts which suffer the highest death-rates from bowel affections, breathes or drinks a large amount of putrefying animal refuse. Salt, or unsound provisions, and bad bread are sometimes accused of producing dysentery, but they are insufficient causes, unless a predisposition is created by those which more profoundly and radically affect the economy, and particularly foul air and the vicissitudes of autumn and winter weather. If it were otherwise, dysentery in the army and navy would not be so generally confined to these two seasons, but would be coincident with faulty provisioning, which is confined to no season, but is most frequent in midwinter. A similar remark is applicable to the use of fruit. It is most abundant when dysentery is least prevalent, from May to September; and all experience shows that some ripe fruits are valuable remedies in this disease. Undoubtedly, however, unripe fruit of any kind, or an excessive use of some species, such as melons and oranges with their pulp, also uncooked pears and apples, may become exciting causes of dysentery. Finally, it may be stated that sporadic dysentery can

generally be traced to some exposure to cold and dampness, or to some error of diet, but that its epidemic form is quite as apt to occur without any definite exciting cause.

The *contagiousness* of dysentery has been both maintained and denied. The truth appears to be that its milder varieties are not contagious, but that its typhoid forms are highly so, and that its intermediate grades sometimes, however rarely, display this property. There is abundant evidence that the disease has been communicated by the dejections of the patients, by the privies or close-stools they have used, and by the clothes they have worn or soiled. Numerous instances prove that the introduction of a single case of dysentery into a hospital has been followed by a diffusion of the disease among the patients; that the arrival of such a patient in a healthy neighborhood has been followed by the attack of persons in direct communication with him; that persons employed in the wards of those sick with dysentery have, without being themselves affected, carried the disease to their families; and, finally, that the attendants upon dysenteric patients, even when they did not contract the disease, exhibited its malignant influence in numerous subcutaneous abscesses and an eruption of sero-purulent blebs, (rupia.) These are sufficient reasons why, in the public service at least, the most scrupulous precautions should be taken, on the one hand, to prevent the concentra-

tion of dysenteric patients in close apartments, and, on the other, to restrict, as much as possible, their communication with other patients, or with persons who are still in health.

It is very doubtful whether dysentery attacks the same person twice. That it does so occasionally is probable; that it does not do so frequently is certain. But there is still a question whether it is to be ranked in this respect with typhoid fever or with typhus, both of which are contagious; but the former protects from subsequent attacks as perfectly as small-pox, while the latter may occur in the same person an indefinite number of times.

Treatment.—Any attempt to describe the treatment of dysentery shows the propriety of studying the several forms of the disease, as has been done in this paper. Each of them requires a procedure which would be improper or insufficient in any other form. So extremely different are these methods, that, while in simple dysentery the essential remedies are almost wholly negative, and the cure may be intrusted to nature alone, the efforts of nature are too often unavailing in the typhoid variety of the disease, and the vigorous intervention of art becomes imperatively necessary to combat the superadded or adventitious state of the system. The bilious phenomena which predominate in another variety would be aggravated by the appropriate remedies of the typhoid form, and in either of these the antiphlogis-

tic method would be inappropriate, although it is sometimes urgently demanded in sthenic dysentery. Finally, the periodical form of dysentery calls for a separate and specific remedy. Nor is there any medicine which can with propriety be called antidysenteric; for although more than one has been vaunted as such, and has even seemed in certain epidemics to be endowed with specific powers, a more extended experience has dissipated the belief, and reduced it to a level with other remedies whose virtues are apparent only in particular stages or types of the disease.

Treatment of Mild Dysentery.—The first step should be to direct the patient to keep his bed, for rest is indispensable to the cure of every form of dysentery; and the next to restrict his food to the mildest farinaceous articles, and especially to rice-water made thin, and strengthened by the addition of from one-fourth to one-half of its quantity of milk. The drinks should consist of thin rice or barley-water, gum-water, etc. In many cases, this regimen, without any medicine whatever, will be sufficient for the cure. It may, however, be expedited by the administration of from half an ounce to an ounce of castor oil, or from ten to twenty grains of calomel, followed in six or eight hours by the castor oil. Either dose may be repeated on the third day, or the calomel may be prescribed upon the first and the oil upon the third day, and should be given in the morning, so

that its operation may be ended by evening, when a small opiate draught, of from five to fifteen drops of laudanum or of wine of opium, or from five to ten grains of Dover's powder, may be administered to promote rather than to enforce sleep, to allay tenesmus, and moderate the frequency of the stools.

If these measures are adopted from the first appearance of the dysenteric symptoms, they will generally arrest the attack in from three to six days; but if they are not employed until several days have elapsed, they will be found less promptly efficient and must be repeated, the purges every second day, and the mild opiates at night, until the tormina and tenesmus have ceased, or nearly so. When this point is reached, acetate of lead in the dose of one grain, or of nitrate of silver in the dose of a quarter or one-half a grain, with one-sixth of a grain of opium, may be given every four or six hours in pilular form. But these remedies should at once be suspended or their dose diminished, if they appear to excite pain in the abdomen, or to increase the quantity of blood or mucus in the stools. After two or three days they should be gradually diminished in frequency of administration or in dose, and then suspended. In their place infusion of chamomile, quassia, or colombo may be prescribed until the appetite and digestive power have been restored.

As the frequency and the bloody appearance of the stools diminish, the food may consist of boiled milk

and lime-water in the proportions of two-thirds of the former and one-third of the latter, with the addition of rice flour, arrow-root, sago, tapioca, or stale bread. The yolk of a fresh egg stirred in boiled and sweetened milk, pure or diluted, is nutritious and generally well digested. The return to solid food should be very gradual. It should be preceded by mutton or chicken broth thoroughly freed from fat, and taken in small quantities at a time. This tender mutton, broiled quickly and not too much, may be cautiously substituted for the more liquid diet, and eaten with stale bread, or bread and butter.

Treatment of Sthenic or Inflammatory Dysentery.— The typical cases of this form of dysentery, as they have been described in the present paper, evidently call for a prompt treatment, and it might seem for strongly antiphlogistic measures. But the appearance of violence in the symptoms conveys an impression of power in them and in the patient, which the operation of such measures proves to be delusive; for under their use the strength is very apt to fail suddenly, and the disease to assume a low asthenic type. This effect is intelligible when we remember that dysentery is not a simple inflammation of the intestine, but a systemic disease, of which the intestinal lesion is merely a local incident, and subordinate in its importance to the affection which involves the whole economy. Hence the apparently clear indication for venesection in the necessity of allaying the

general violence of action and the local distress is calculated only to mislead, as it has done many physicians who afterward abandoned it as mischievous. The abstraction of blood by cups or leeches near the seat of the local distress is, however, a palliative, but only a palliative, which should not be neglected, particularly when the region of the sigmoid flexure of the colon is very tender upon pressure, or the sensibility of the abdomen renders the existence of a peritonitis probable.

If the patient is robust and the pulse of good force and volume, saline laxatives constitute the most efficient and the promptest means of relief. Epsom salts, or, still better, Rochelle salts, in the proportion of one ounce of either to a quart of water, of which a wineglassful is given every two hours, will generally in the course of a few hours diminish or even suspend entirely the tenesmus and produce a free discharge of bilious and watery stools. After this treatment has been pursued for eighteen or twenty-four hours, it should be suspended for an equal space of time, and meanwhile doses of three or five grains of Dover's powder repeated at intervals of three hours, after which the saline may be resumed as at first. Two or three such courses are generally sufficient, and in the cases especially referred to constitute the most effectual palliative of the local distress, and the speediest cure of the disease. In the intervals between the courses of saline laxatives, weak chicken

or mutton broth is generally well borne; but if not, the amylaceous preparations may be substituted. The copious use of rice-water or barley-water, or, still better, of rennet-whey or of chicken-water, should be encouraged.

If the patient is not of a vigorous constitution and is not affected with purely sthenic dysentery, purgative doses of calomel are preferable to the salines. These should be prescribed in the dose of twenty grains, with a grain of opium in a single dose, or in two or three doses of from five to ten grains of calomel, and one grain of opium in each, to be taken at intervals of six or eight hours, and followed, after a similar space of time, by an ounce of castor oil. Usually, before the latter medicine is administered, there is a marked abatement of the patient's sufferings and of the frequency of the stools, and the calomel has not to be repeated. Under this medicine the evacuations also change their character, and contain bile and feculent matter rather than blood. The remainder of the medical treatment may in general be confined to five-grain doses of Dover's powder every five or six hours, or from three to five grains of ipecacuanha, with half a grain or a grain of opium at like intervals; or, if the sthenic character of the symptoms be still decided, a grain of calomel may be added to each dose of either of the powders just referred to. But such an addition is not generally advisable, owing to the risk of inducing salivation.

If the stools oblige the patient to rise frequently at night, and so prevent his obtaining rest, a full dose of opium (one or two grains) or eight or ten grains of Dover's powder should be administered at bed-time.

Enemata are useful in this form of dysentery, if in any acute form, of which there is serious doubt. If frequently repeated, they are excessively annoying, and often appear to augment the irritability of the rectum. But occasionally and appropriately employed, they serve to palliate the tenesmus and the irritation of the organs adjacent to the rectum. For this purpose they may consist of half a pint of cold water or of tepid flaxseed tea, according to the impression which the two make upon trial; or of two ounces of fresh melted lard or sweet oil; or, finally, of from twenty to sixty drops of laudanum in mucilage. This last should be given in very small bulk, not exceeding half a wineglassful. In the decline of the attack, solutions of nitrate of silver, (gr. ii to gr. v in a wineglassful of water,) or the same quantity of liquid containing from five to fifteen drops of the diluted solution of subacetate of lead, may be used as enemata two or three times a day. Opiate suppositories, containing from one to three grains of opium, are sometimes preferable to injections.

Warm emollient poultices of Indian or flaxseed meal applied to the abdomen are very soothing, at least upon their first application, and may be ren-

dered more so by being made with the liquor from a decoction of hops, or by being moistened with laudanum. Woolen cloths wrung out of hot water and sprinkled with oil of turpentine form a very useful epithem for the same purpose; and liniments of camphorated oil and chloroform are not without their advantages. If such applications as these fail of giving relief, a blistering plaster over the seat of pain will generally succeed. It should not remain applied longer than three or four hours, after which time vesication will readily occur under a warm poultice or even a dressing of simple cerate.

When the acute symptoms have all declined, and the number of stools has fallen considerably, and they no longer contain mucus or blood, all other medicines may be laid aside in favor of acetate of lead and opium, of which one grain of the former and half a grain of the latter may be administered every three, four, or five hours, the intervals between the doses being gradually lengthened as the frequency of the discharges diminishes and their consistence increases. This combination is greatly superior in efficacy to any preparation whatever of vegetable astringents. If, as sometimes happens, it occasions scybalous dejections, it should be suspended for a day, and a small dose, of perhaps half an ounce of castor oil, administered, to cleanse the colon. If, after this, loose stools continue, the lead should be resumed, but not otherwise.

The cautions in regard to diet during convalescence need not be repeated here, but it may be remarked that they ought to be most sedulously observed in this graver form of dysentery.

Treatment of Bilious Dysentery.—The characteristic symptoms of bilious dysentery, it will be remembered, indicate derangement of the stomach and liver, either with active inflammatory symptoms, but less so than in the last form, or showing a tendency toward an adynamic condition of the system. The peculiarity of the treatment which it requires is, that while evacuants are not less important than in sthenic dysentery, emetics take precedence of purgatives. If the patient is early seen, twenty or thirty grains of ipecacuanha should be administered, and its operation, when once fairly begun, should be assisted with copious draughts of warm barley-water. The relief afforded by this evacuant is sometimes very decided. It should be followed, as soon as the stomach is settled, with a mild saline laxative largely diluted, such as half an ounce or an ounce of Rochelle salts, or of cream of tartar in a pint of water, of which a wineglassful may be administered every two hours, with four or five drops of wine or tincture of opium.

It is well known that ipecacuanha when first introduced into European practice was held to be a specific for dysentery, for it was so considered in South America, whence it came. It was then employed as follows: two drachms of the bruised root

were infused over night, or else boiled in four ounces of water, which were administered early in the morning to the patient fasting. This dose, prepared from the same portion of ipecacuanha, was repeated for two or three consecutive days. We are assured that it strengthened rather than debilitated. Quite recently we learn that the remedy is still regarded as a specific in Peru, and that it should be prescribed in the following manner: from half a drachm to a drachm of powdered ipecacuanha, mixed with a little syrup and water, is given early in the morning, and the patient is directed to lie quietly and to avoid drinking anything to excite vomiting. Night and morning an enema is administered of the infusion of bruised ipecacuanha in twenty-four ounces of water, to which one ounce of "syrup of morphia" is added. The powder and the enema are thus employed for three or four successive days. Little vomiting is produced, but the second or third dose causes copious bilious stools, which is the proposed effect of the medicine. When this is accomplished, an ounce or two of castor oil is exhibited, and when it has ceased to operate, the evacuant treatment is ended. The cure may then be intrusted to mild astringents and opiates. If the case is too urgent to admit of the delay necessary for the systematic plan here indicated, it is advised to administer ten grains of powdered ipecacuanha and one grain of opium every six or eight hours, and the enema above described, night

and morning, until the urgent symptoms are arrested. (WHITTINGHAM, *Am. Journ. of Med. Sci.*, October, 1860, p. 381.)

Instead of seeking either the emetic or the specific operation of ipecacuanha alone, we may obtain its peculiar benefits through the emeto-cathartic effect of ipecacuanha and calomel together, by administering twenty grains of the former with ten or fifteen grains of the latter. On the next day the saline solutions already recommended, and on the following day the calomel alone may be repeated, or if the gastric disturbance still forms a prominent symptom, the ipecacuanha also. But this method is applicable chiefly in the forming stage of the attack, at which time, if the evacuant operation is thorough, the further progress of the disease may be arrested or rendered very mild. Its use, however, should be restricted in cases in which the constitutional vigor is but slightly impaired.

We cannot have too strongly impressed upon the mind that calomel, invaluable though it be on account of its gentleness as a purgative and its specific operation on the liver, may nevertheless expose the patient to danger by its primary depressing influence, and by the possibility of its occasioning salivation, or by the other and remoter effects of mercurial poisoning. In the decidedly sthenic variety of dysentery, the danger of these accidents is, indeed, very slight; and even in the bilious form they are com-

paratively small, if the medicine is used as a purgative only: but in either form they are greatly increased by the vicissitudes of military life. It therefore becomes the duty of the army surgeon not to employ mercury in large or in small doses, unless simpler remedies have proved inefficacious in other cases of the disease. When in doubtful cases it has been prescribed, its sojourn in the system should be prevented by the timely administration of castor oil or saline laxatives.

It may not be amiss to remark that ipecacuanha, in the small dose of one grain every four or six hours, has been proclaimed as a specific for all the active forms of dysentery. A larger dose than this occasions so much distress from nausea as to render it ineligible for repetition.

In bilious dysentery the premature exhibition of opiates is to be sedulously avoided, because they check the secretion of bile which it is desirable on the contrary to promote. But when once bilious evacuations have been procured, the administration of small doses of wine of opium or of Dover's powder may be cautiously resorted to for allaying pain and lessening the discharges.

In this variety of the disease, even more perhaps than in the purely inflammatory form, a diet composed in part of acidulous drinks is grateful to the patient. The pulp either of roasted apples or of ripe grapes has been found peculiarly serviceable;

and in no other description of dysentery is buttermilk more eagerly taken by those who are used to it as a drink, and sometimes by those who are not. We have carried many cases of simple and of asthenic dysentery to a safe issue with no other medicine or food than this acidulous and nutritious liquid. Panada may likewise be mentioned here as a form of nourishment adapted to all the active forms of the disease. It is made as follows: take an ounce of stale wheat bread and pour on it a pint of boiling water. When the mixture has stood for an hour, beat it up and boil it for ten minutes. It may then be sweetened, and flavored with a little wine and cinnamon, or nutmeg. The above-mentioned varieties of food may be alternated with diluted milk and farinaceous articles, and rennet-whey may be freely taken as a drink. As the symptoms subside, mutton tea, made from the lean meat and freed from fat still further by skimming, may be allowed with stale bread or rice; but solid food, as in the other forms of the disease, is very gradually and cautiously to be resumed.

Treatment of Malignant or Typhoid Dysentery.—This affection, in its worst form, that is, when besides the typhoid state it is complicated with scurvy, is but little, if at all, amenable to medical treatment. It was this form of dysentery which, like a pestilence, ravaged the British army in the Crimea, and of whose treatment the official report to Parliament holds the following language:—

"The medical officers of the army were unanimous in their opinion of the inadequacy of mere drugs in the treatment of these affections, and in the numerous reports which we have consulted, almost every medicine is mentioned either with disrespect, or in terms of very sparing commendation: but of those which are most favorably alluded to, opium and the combination of gray powder, [mercury with chalk,] ipecacuanha, the mineral acids, and the preparations of iron seem to have enjoyed the greatest degree of confidence; charcoal also was administered in some regiments, alone and in combination with camphor, with apparent advantage, and quinine was early resorted to on account of the periodic nature of these affections in some instances; but no decided testimony to its usefulness can be procured, and it was more often prescribed only in the convalescent stages. During the early period of the siege, of all the remedies which were had recourse to the most constantly in use were the astringents, vegetable and mineral, and of these by far the most valuable in the general estimation was opium, for it served to induce sleep, (an important consideration,) to moderate the intestinal discharges, sustain the capillary circulation, and to give tone to the smaller vessels. It required, however, to be used with caution, and if pushed too far, it lowered the circulation and predisposed to gangrene in the parts most distant from the heart. The other astringents were of doubtful merit, and soon sank into disrepute; for though in some cases, when diarrhœa seemed to have degenerated into a habit, from mere want of tone and elasticity in the system, they might have proved useful in controlling the flux, yet * * * it will appear extremely questionable whether these remedies were not, in most cases, of doubtful application, and whether they may not sometimes have proved injurious by suddenly and forcibly arresting the course of the flux, and thus precipitating the patient into a reactionary febrile state. Upon this point, however, it is obvious that every observer will have formed his own opinion, and we shall, therefore, only further remark

that, in our own experience, that which the strongest styptics were only able to control for a few hours, and with great inconvenience, nay, often much pain to the patient, a few days on a diet of rice milk, of potatoes, and essence of beef, sufficed to arrest; and we were, therefore, forced to conclude that these affections, in their primary design, were conservative of nature, and that they were only to be successfully and safely combated by removing the necessity of such a drain from the system, and introducing into the circulation the elements of healthy blood—good food; and of healthy sanguification—pure air," etc.

The report goes on to remark that when the diarrhœa was marked by the appearance of undigested aliment (salt meat) in the dejections, lime-juice was found a very useful remedy, and also when the bowel complaints were associated with a scorbutic taint of the system. It was administered two or three times a day, in doses ranging from one to three ounces, with sugar and water. Even in diarrhœa of the more severe or dysenteric character, it never proved injurious if exhibited in barley or rice water, and in combination with opium. It is to be borne in mind that the scorbutic element which the lime-juice was employed to correct can never present itself if the soldiers receive a proper supply of fresh meat and vegetables, and due attention is paid to their hygienic condition.

The views and precepts here presented are in full confirmation of those contained in the writings of all the eminent physicians in Europe, whether British or continental, who have treated of this subject. It may

be added that these writers are agreed in regard to the value of external stimulant applications to the abdomen, such as spice plasters, sinapisms, and particularly turpentine stupes made by sprinkling spirits of turpentine upon woolen cloths wrung out of hot water. When the condition of the patient does not contraindicate the use of blisters, their application to the abdomen during a period of from three to six hours is often of essential service. If the skin is very harsh and dry, it should be frequently sponged with chlorinated water or with vinegar. Alcoholic drinks, although they may appear to be indicated by the extreme prostration of the patient, must be very cautiously prescribed, for however they may tend to rouse his flagging energies, they are also, by continued use or in large quantities, very apt to exhaust the vital powers. A similar danger, it has already been stated, attends the use of opium. The decoctions of Peruvian bark and Huxham's tincture are preferable to quinia, when a tonic and not an antiperiodic operation is intended. Camphor, valerian, serpentaria, ammonia, and also turpentine have been recommended as internal stimulants, but they are ineligible because they tend to disorder the stomach and irritate the bowels. Perhaps the only medicinal substance besides opium which is appropriate for internal use in this form of dysentery is nitrate of silver. It may be prescribed in doses of one or two grains, and in pilular form, every four hours, until a change in the

quality or the frequency of the discharges takes place. Although this remedy is not so efficacious in the extreme cases of the variety of dysentery under consideration as when the vigor of the constitution is less completely undermined and the character of the disease is simpler, it has the advantage of being perfectly innocuous in the doses which are here advised.

But whatever medicines and whatever varieties of food may be employed to combat the dysenteric, the typhoid, or the scorbutic element of the disease, they will be of little avail unless their influence is sustained by appropriate hygienic measures, and particularly by a change of air. A constant renewal of the air is an essential element of the cure wherever dysenteric patients are treated, and it is, if possible, more imperatively necessary when the form of the disease is the one at present under consideration. But no degree of ventilation in the tents or wards occupied by the sick in the locality where the disease broke out, will equal in efficiency their removal to a more salubrious situation.

Treatment of Periodical Dysentery.—Dysentery complicated with periodical fever is amenable to quinia in proportion to the predominance of the periodical type; that is to say, in proportion to the distinctness with which there is a freedom from all active symptoms in the periods between the paroxysms. When the suspension of these symptoms is most complete, quinia alone will frequently, indeed generally, suffice

to terminate the complex disease; when, however, the dysenteric phenomena persist between the periodical exacerbations, quinia may arrest the latter without materially influencing the former. A compound treatment then becomes necessary, in which, if gastric derangement is present, an emetic dose of ipecacuanha and calomel (twenty grains of the former to ten or fifteen of the latter) should be premised, and when its operation has ceased, quinia may be prescribed in solution, in the dose of from three to five grains every three or four hours, guarded by four or five drops of laudanum in each dose, or accompanied by two or three grains of Dover's powder. If there is no disorder of the stomach, the emetic of ipecacuanha may be omitted at the commencement of the treatment, and castor oil be substituted for the calomel. When the periodical character of the disease has disappeared, the dysenteric symptoms, if any continue, should be managed in the manner already laid down, and in accordance with the grade and type which they then present.

Treatment of Chronic Dysentery.—Appropriate diet and regimen are essential to, and often sufficient for, the cure of this affection, provided that permanent organic alterations of the colon or rectum have not been established. Hence the urgent necessity of withholding from the patient his ordinary food when this is coarse and too abundant, and from his usual occupations when they involve undue fatigue or ex-

posure. The most useful form of diet is milk, with bread or other mild farinaceous preparations, especially rice, and a gradual and cautious return to solid food, consisting of mutton, beef, or poultry, in very small quantities at a time. Many cases are cured by lime-water and boiled milk, in equal parts, with the addition of biscuit, if tender, or softened by hot water and slightly salted if it is hard and stale. Both bread and biscuit, if toasted, are thereby rendered more agreeable to the taste and more digestible. Soups are generally ineligible, for they are apt to occasion flatus, griping, and an increased frequency of the discharges. It is of the utmost importance that the drinking water should be of good quality. If it contain any appreciable amount of vegetable or mineral matter, it should be purified by boiling. While moderate exercise in fair weather promotes the cure, fatigue is to be avoided, and suitable clothing, especially a flannel shirt, should be prescribed as essential. In warm weather sea bathing, if not unduly prolonged, is of decided service.

The medicinal treatment of chronic dysentery demands great circumspection and judgment, to adapt it to the peculiarities of each particular case. If the irritability of the bowels is very great, indicating, probably, a certain degree of inflammatory action, warm fomentations of the abdomen, opium in small doses, and nitrate of silver or acetate of lead, should be employed. The dejections ought to be frequently

inspected, and if found to contain scybala, half an ounce of castor oil, or ten or fifteen grains of rhubarb, either alone, or with about five grains of blue mass, should be prescribed. In more atonic forms, nitrate of silver and acetate of lead are still the most useful remedies of their class, and next to them sulphate of copper ranks; but with all, the association of a small proportion of opium is advisable. Among remedies of this kind, balsam of copaiva is one of the most valuable. In these, as well as in the preceding form of chronic dysentery, blisters to the abdomen may be resorted to with decided advantage, provided the strength of the patient is not very greatly reduced; but they should not remain applied long enough to produce a suppurating surface. If the appetite is feeble, and digestion imperfectly performed, the bitter vegetable tonics are indicated, as cinchona, colomba, simaruba, and angustura, the last two of which are reputed to have a specific virtue in dysentery. Angustura is even held to possess peculiar advantages in the low forms of the acute disease. It is important that the decoction or infusion of these bitters should not be unduly strong. Finally, when anæmia complicates the disorder of the bowel, and bitter vegetable preparations fail to invigorate digestion, iron should be prescribed, and particularly the preparations which possess a marked astringency, as the muriated tincture, the persesquinitrate, and the perchloride. These remedies may be appropriately alternated with the vegetable bitters.

If the local irritation about the rectum continues, so as to occasion tenesmus, it may be palliated by leeches around the margin of the anus, by the application of warm narcotic vapors, or warm hip-baths; by injections or suppositories of opium or belladonna, or by the injection of a solution of nitrate of silver, containing from one to five grains of the salt, to an ounce of water. On the other hand, if a relaxed atonic condition of the anus exists, it should be treated with cold hip-baths and cold astringent injections, particularly such of the latter as contain the acetate or subacetate of lead. The tincture of nux vomica or strychnia may be administered internally, the former in the dose of five drops, gradually augmented, and the latter, in the dose of one-twentieth of a grain, cautiously increased. Strychnia has also been inoculated in the neighborhood of the anus, when the sphincter has lost its power, and there is more or less prolapse of the rectum.

Of the Prevention of Dysentery in Camps, etc.—This subject may be considered, 1, in relation to the means to be employed for preventing the occurrence of the disease; and 2, in relation to those which are adapted to lessen its malignity, and oppose its extension, where it has already broken out. The ample instructions furnished by the publications of this Commission in regard to the sanitary regulations of camps and hospitals, render it unnecessary to lengthen the present paper by any details upon either

branch of the subject. It will be sufficient to remark that dysentery is most efficiently prevented by dryness and purity of the air; the absence of malarious and putrescent effluvia; warm clothing; the avoidance of the hot mid-day sun, and of chill by night air, or sleeping on the damp ground; by active exercise, to promote warmth, rather than by trusting to artificial heat, and therefore by games and sports, as well as by frequent drill; by camp fires, to dry the clothing in damp weather, and by stoves, to dry the tents, rather than to heat them. In summer, the men should be obliged to bathe frequently, and at all times to observe the most perfect personal cleanliness.

The food should always be composed of a large proportion of fresh vegetable matter, and the utmost care taken to render it both palatable and digestible, by appropriate cooking, an art the most neglected and rudimentary among us, even in civil life, and in times of peace and plenty. If the drinking water is not pure, it should, as already remarked, be boiled before being used; and this precaution against the mischievous effects of vegetable and mineral impurities, is of the first necessity in the treatment of the sick. Alcoholic drinks should be used sparingly; intemperance is the direct road to the hospital.

If dysentery have already broken out, the essential conditions for staying its progress is a removal to a healthier locality; if this cannot be done, then the

most important element of cure is fresh air. So essential is it, that cold is of secondary consequence in comparison. All observation teaches that the sick with this disease, and with typhus, and some other affections, are much more apt to recover in tents, or other imperfectly closed habitations, than in well-built hospitals. In the latter, but indeed everywhere, the utmost care should be given to prevent other persons from using as a privy the place frequented by dysenteric patients. The fecal matter should either be removed at once, or its emanations prevented by the addition to it of quicklime.

PAIN AND ANÆSTHETICS.

PAIN AND ANÆSTHETICS.

Among the many improvements which characterize modern surgery, one of the most invaluable is the introduction of Anæsthetics. That we should be enabled safely and conveniently to place the human system in such a state, that the most painful operations may be performed without consciousness, is to have secured to man immunity from what he most dreads; for most men fear pain even more than death. When seeking death by suicide, the instinctive aversion to pain is apt to govern in the choice of means, and the person generally selects the method which he imagines will inflict upon him the least suffering.

Pain humbles the proudest and subdues the strongest. It was the great agent of the Spanish inquisition, because it was more effective to extort confession than death itself. It was pain that made Cæsar weep; and I have seen the most heroic and stout-hearted men shed tears like a child, when enduring the anguish of neuralgia. As in a powerful engine when the director turns some little key, and

the monster is at once aroused, and plunges along the pathway, screaming and breathing forth flames in the majesty of his power, so the hero of a hundred battles, if perchance a filament of nerve is compressed, is seized with spasms, and struggles to escape the unendurable agony. We have then this, the first reason for the use of anæsthetics:—

To prevent pain is humane. No gentleman, not to say Christian, would needlessly inflict pain on any creature. It was, indeed, a certain kind of humanity which led the Athenians to execute Socrates by means of a narcotic draught, and which also made the Romans give their malefactors, during crucifixion, drugged wine. Even the guillotine had its conception in a kind of humane sentiment. Only savages inflict upon their victims the horrors of torture. And I do not believe that there is a surgeon of the nineteenth century who would willingly inflict any unnecessary pain in his operations if once practically acquainted with the means of prevention, and once confident and facile in their use.

But, secondly: *Pain is useless to the pained.* So Galen said centuries ago, and so the late discussions of the question of anæsthesia have abundantly proved; and if any members of the medical profession still entertain the idea that pain may have some occult, mysterious use, with which it would be dangerous to dispense, we must remember that the general sentiment of our profession, together with the

common sense of mankind, is now unquestionably far in the advance.

The torment of toothache and the griping of colic confer no benefit on the sufferers; and all experience proves that the step proper to be taken first in the cure of these diseases is to relieve the pain.

When the pain produced by a surgical operation, or any other injury, is excessive, the exhaustion is greater, reaction comes on more slowly, the subsequent process of restoration is delayed, and the tendency to depression is increased. The practice of applying irritating applications and stimulating plasters to phlegmons has long been confined to the ignorant—the educated surgeon preferring soothing poultices and sedative lotions. But this reason may be made stronger; since

Pain is positively injurious to the pained. If sufficiently acute and long continued, it will of itself produce death. The collapse which follows severe injuries, where there is little loss of blood, is to be attributed entirely to pain. When death occurs in such cases without reaction, it is the direct effect of pain.

Ambrose Paré, the father of modern surgery, in speaking of pain, says, "nothing so much dejects the powers of the patient." Gooch says, "mere pain can destroy the powers of life." My friend, Mr. Travers, observes, "pain, when amounting to a certain degree of intensity and duration, is of itself destructive."

And I myself, like every other surgeon in active practice, am continually witnessing injuries where death results solely from the nervous shock.

In corroboration of this fact, we may notice, *en passant*, the Statistics of Amputations, collected by Professor Simpson, of Edinburgh. It is not necessary to quote them at length, but they come, by numeric process, to this conclusion—that in all serious surgical operations the prevention of pain, by the use of anæsthetics, gives to the patient not only present relief, but also a better prospect of subsequent recovery —the mortality in such cases being clearly lessened by the use of anæsthetics. We see, then, that pain has the effect, primarily and directly, to depress the powers of life.

If we inquire into the cause of this, we shall find it in the physiological law, that the *nervous system controls the vascular*, and the collapse which attends severe injuries has its origin in the nervous system. Collapse is a provision for defending the nervous centers from an intolerable assault, and in this way does nature herself in a manner dictate the use of anæsthetics. It was probably in supposed obedience to this indication that John Hunter, great and ingenious even in his errors, advocated amputation before reaction had occurred. He meant to avoid the nervous shock.

In collapse, the return of nervous energy precedes the restoration of the circulation; and, admitting all

that is claimed for the chemical origin of the forces which produce the circulation of the blood, we must still allow that the current is controlled and directed by nervous influence. The most severe operation during anæsthesia produces little or no effect upon the pulse, because the nervous centers receive little or no impression.

Whatever, then, may be the physiological necessity for pain, though its uses in the animal economy may be to prevent lesion and deter from danger, we are here to view the question merely in a therapeutic light, and to conclude that pain is only evil, and that continually. And now, how shall it be prevented? Obviously by any means which will produce a less injurious effect. We are not required to possess an absolutely innocuous agent; if the injurious effect of the means used be less than that of the pain prevented, we are justified in employing them.

If we examine these doctrines carefully, we shall find that they are in fact not essentially new. The principles on which they are founded have been long recognized *in the use of narcotics.* I was in the habit of giving opiates freely before the introduction of anæsthetics, both before and after operations; and now, after over fifty years of experience, I still retain them in my confidence, for their power to relieve pain after operations, thus improving the condition of the patient, and favorably modifying the subsequent inflammation. In the treatment of certain

painful affections, such as puerperal fever or peritonitis, opium is well known not only to be palliative, but directly curative. Richter called it "the grand antiphlogistic remedy."

It has always been used more freely by surgeons in this country than in Europe, and to this cause I attribute, in great measure, our lesser subsequent mortality. And opium and its preparations are the only anodynes well adapted to surgical use. No substitutes are worthy of confidence.

When chloroform or ether is to be used, it is not advisable to give an opiate previous to the operation, as to do so would increase the tendency to subsequent vomiting, which every experienced surgeon is anxious to avoid. When the system is laboring under the shock of any newly-received and severe injury, the powers of life are in abeyance, and the act of retching tends to an unfortunate issue. In collapse, if the patient vomit, he is apt to die.

In cases of hare-lip, however, and in operations about the mouth and jaws and nose, we are frequently compelled to depend, as formerly, upon narcotics for preventing or mitigating the pain, as the locality renders inhalation impracticable.

After operations, opiates are to be used, without much reference to quantity in proportion to the severity of the pain. The only injurious effect of their too free exhibition would be after some hours a little irritability of the stomach. Their constipating

tendency in such cases is of no therapeutic importance, and would in no degree increase the subsequent local inflammation.

Alcoholic stimulants are also well known to exercise a limited anæsthetic power. Men in a condition of complete intoxication are sometimes unconscious of the injuries they receive, and formerly some surgeons were in the habit of benumbing the sensibility of the patient, and sometimes I fear their own, by copious draughts of spirituous liquors. But this practice can, at best, produce but very imperfect anæsthesia, and intoxicating drinks are still more apt to disturb the stomach than opium. I well remember a case of amputation of the thigh which occurred a few years since in my own practice, where the attending physician, notwithstanding repeated cautions, administered brandy to the patient so freely as to induce vomiting, thus interfering with the continuance of the reaction, and inducing a fatal result. It was an extensive cannon shot of the knee-joint, and on the third day from the injury, before the collapse had sufficiently passed off.

But opium and alcohol have been referred to, rather as illustrations of the truth of the principles of anæsthesia than as practicable anæsthetic agents. To produce any considerable insensibility with them would require their use in quantities and for a length of time that could not fail to be seriously injurious to the nervous system. Days would be required to re-

cover from their narcotic effect. Hence it is, that such agents are of little account when compared with inhalations.

The great extent of the pulmonary surface, and the facility with which aeriform agents may be introduced through it into the circulation—their complete efficiency and their ready evacuation by respiration—conclusively indicate that the lungs, instead of the stomach, is the best route through which to introduce the proper agents for inducing insensibility. Now, the question arises, can these advantages be secured without danger to the patient? And sufficient time has already elapsed to enable us to reply: *Anæsthetics, when properly used, are perfectly safe.*

At the period of my last visit to Europe, some ten years since, Professor Simpson had then given chloroform to over 8000 persons without a single fatal result from its use, and by this time he has, no doubt, more than duplicated that experience. In the Crimean war, it was used commonly and freely. Baudens speaks of several thousand cases in which it had been used without accident, and Macleod reports over 20,000 cases, with only a single fatality. Even when ignorantly and carelessly employed, there is less danger than is commonly apprehended. When last in Paris, I saw it used continually, and freely, and carelessly, with little precaution to dilute the vapor, and by rude means,—a sort of bag tied over the mouth and nose of the patient,—yet heard of no case of as-

phyxia from its use. Both chloroform and ether are continually employed in this city, [New York,] in the hospitals and public institutions, as well as in private practice, with little or no regard to either the quantity or intensity of the vapor, and yet but very few accidents have occurred. In my own practice, I have never seen a death from their use.*

But there is another reason for employing anæsthetics which must not be forgotten. *The insensibility* of the patient is a *great convenience to the surgeon.*

How often, when operating in some deep, dark wound, along the course of some great vein, with thin walls, alternately distended and flaccid with the vital current,—how often have I dreaded that some unfortunate struggle of the patient would deviate the knife a little from its proper course, and that I, who fain would be the deliverer, should involuntarily become the executioner, seeing my patient perish in my hands by the most appalling form of death! Had he been insensible, I should have felt no alarm.

By the use of anæsthetics, also, the shrieks and cries of the patient are prevented; so that the surgeon's powers are not additionally taxed, either to nerve himself to a very unpleasant task, or to control and encourage the attendants.

This discovery, then, has not only taken from sur-

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* Chloroform and ether have been used to an immense extent during the present rebellion, and with the best results.—W. A. H.

gery its greatest horrors, but it has also very much increased the facility and safety of operations; and in this way the *domain of surgery is extended.*

In the removal of tumors with intricate surgical relations, the operator now feels at liberty to take the amount of time required for careful and slow dissection. He performs painful operations on children with little or no fear of subsequent convulsions, and the nervous and timid are so protected from the shock that he is free to assert the dominion of the knife wherever science has decreed and the powers of the human constitution will allow.

But it is the object of this paper not only to show the propriety of inducing insensibility to pain, but also to give some plain and practical

DIRECTIONS FOR THE USE OF ANÆSTHETICS.

Of these agents, only two—ether and chloroform—are as yet worthy of consideration; and of these I have always preferred chloroform, for the reason that it is more effective. Ether has been supposed to be safer in the hands of the inexperienced, but this is clearly no reason why the practiced surgeon should confine himself to the weaker and more inconvenient agent. Ether is longer in producing anæsthesia, is more bulky, and in some cases fails to produce the desired effect. I am in the habit, however, of employing both, commonly commencing with ether, and

resorting to chloroform if insensibility is not readily induced.

It is better to employ no special apparatus for inhalation. All that is needed is a common linen handkerchief, on which the liquid is poured. This should be held loosely in the hands of the operator, as in the folded condition it might interfere too much with respiration. If ether is used, little attention is paid to quantity—from two to four ounces being commonly required for an adult; and all the caution necessary is not to exhibit it so rapidly as to excite a cough. If chloroform is employed, less quantity will be required—from one to four drachms being generally sufficient. But care must be taken to dilute the vapor sufficiently with atmospheric air.

During the inhalation the patient should always be in a recumbent position. We must remember that the vapor of chloroform is exceedingly heavy, having a specific gravity more than four times that of common air, with little disposition to diffuse itself. Carbonic acid, which weighs only one and a half times more than common air, may be poured from one vessel into another like water. By reason, then, of its great gravity, the vapor of chloroform passes into the lungs more readily when inhaled in the recumbent posture; and if for any reason we should desire to free the lungs speedily from its presence, we can do so with most facility when the patient is in the same position.

The circulation of the blood through the lungs is

now known to depend on the reaction of its carbonized constituents with the oxygen of the air; and in those cases where death has occurred during inhalation, this result is to be attributed rather to the absence of oxygen in the lungs than to the presence of chloroform in the blood.

We may presume that anæsthetic vapors are not poisonous of themselves, but when ignorantly or carelessly used they arrest the circulation in the capillaries of the lungs, as nitrogen or hydrogen would do by exclusion of the necessary oxygen. Hence, in case of asphyxia from their use, where the natural process of respiration is interrupted, we endeavor to substitute it by artificial means. We open the windows to procure fresh air, dash cold water in the face to excite convulsive respiratory movements, turn the patient on his side to lessen the gravitative tendency of the vapor, and make artificial respiration by compressing the ribs after the manner of Dr. Marshall Hall. And when the vapor is sufficiently displaced from the lungs by admixture with atmospheric air, circulation and respiration will both be restored. For these reasons, it was, that Mr. McLeod, in the Crimea, always preferred to use chloroform in the open air.

We see, then, that to *exhibit anæsthetic vapors too rapidly is to incur the danger of asphyxia;* but, on the other hand, to exhibit them too slowly incommodes the surgeon and prolongs inconveniently the

stage of excitement; and a greater quantity of the anæsthetic will also be required, and spasmodic action of the glottis is more likely to occur.

Professor Simpson speaks of one or two minutes as being the proper time to allow for the induction of insensibility, but in this country it is customary to take a longer time, perhaps from three to five minutes.

The full effect of the anæsthetic is indicated by sonorous or even stertorous breathing, which, though apparently serious, is of no importance. The pulse is generally but little affected, though it is often diminished somewhat in frequency and force, and yet I have seen it, when the vapor was being administered too rapidly, suddenly stop, to resume its ordinary motion when the effect of the vapor passed off.

There is another practical fact in regard to the use of inhalations which I do not remember to have seen noticed. *If the patient vomit, the effect immediately passes off,* and, as he is much more likely to vomit when the stomach is full, he should not be allowed food for some hours previous to inhalation.

In operations where the mouth becomes filled with blood, I was formerly apprehensive of strangling, but subsequent observation shows that during anæsthesia, deglutition takes place by means of reflex nervous action, in the same manner that uterine contractions occur, notwithstanding the use of these agents.

Within the last year, Professor Simpson, of Edin-

burgh, has recommended a new plan for securing the admixture of the proper quantity of air. It consists in spreading a handkerchief single-fold over the face of the patient, and allowing the liquid to fall drop by drop upon it near the mouth and nose. The quantity of the liquid required by this method is said to be less than what is ordinarily used, but from my experience I should apprehend irritation of the skin, as this is apt to occur in using chloroform and ether by the ordinary method. To prevent this irritation I am in the habit of applying, previous to inhalation, a little olive oil about the mouth and nostrils. Care should also be taken to prevent the vapor from acting on the eyes.

In my own practice I have been in the habit of using the Scotch chloroform of Duncan, Flockhart & Co., of Edinburgh, but have also employed that of Dr. Squibb, of Brooklyn, and with pleasure commend the latter for its purity and reliability.

For such reasons, then, as have been recounted, I desire to direct the attention of the surgeons of the army and navy to the advantages which would accrue from a more extended use of anæsthetics in naval and military practice. I am satisfied that if, in their operations, the pain were more generally prevented, many lives would be saved which are now lost from the shock to the nervous system, and that, in all severe cases, the prospect of recovery is better and the subsequent inflammation is milder when an anæsthetic has been used.

To this conclusion I have not come hastily. Of so much import have I always regarded the prevention of the pain of operations, and so desirable, if it could be practically effected, that ten years before the introduction of anæsthetic vapor I listened patiently and attentively to the claims of animal magnetism to this power to produce insensibility; but found, and I may say with unalloyed regret, that when fairly brought to the test, its most ardent friends were compelled to admit its utter inefficiency, and even since the invention of anæsthetic inhalation, I have carefully tested the power of other agents, such as nitrous oxide, to produce insensibility to pain, but still consider none of them deserving of mention when compared with chloroform or ether.

In conclusion, perhaps I may say that these observations and reflections have been made during the intervals taken from a business still pressing, at a time of life when most men desire repose. They are given to the cause of American nationality, and may claim to be at least an old surgeon's offering on the altar of his country. The flag of our Union, the glorious Stars and Stripes, has repeatedly protected me in foreign lands beneath its broad folds, and if what I have written here shall be in any measure successful in preventing the sufferings and prolonging the lives of that noble army who are now serving under my country's banner, I shall receive my reward.

HEMORRHAGE FROM WOUNDS,

AND THE

BEST MEANS OF ARRESTING IT.

HEMORRHAGE FROM WOUNDS,

AND THE

BEST MEANS OF ARRESTING IT.

Ter sese attollens cubitoque annixa levavit,
Ter revoluta toro est oeculisque errantibus alto
Quasivit Cœlem lueem ingemuitque reperta.

Thriee Dido tried to raise her drooping head,
And fainting thrice fell groveling on the bed.—DRYDEN.

THIS beautiful description of the death of the Tyrean queen by hemorrhage is as true to nature to-day as it was two thousand years ago. The successive periods of syncope and of recovery are so admirably depicted, that we almost wonder why the ancients, though they knew nothing of the circulation of the blood, did not proceed a single step, and discover that the paroxysms of fainting were immediately due to the "*sese attollens*," the erect posture, and the consequent deficient supply of blood to the brain. And yet, simple and true as this law of nature ever has been and still is, I fear that thousands of poor soldiers in our armies are annually

losing their lives from its violation, through the mistaken kindness of their friends.

When a wounded soldier faints, his companions are too apt to leave the ranks and place him in the sitting position, sprinkle him with water, and endeavor by all the means in their power to excite him to consciousness. In this way syncope, that might be only temporary, is many times rendered permanent and fatal; for the formation of a clot in the wound, which is the man's only hope of stopping the flow of blood, is thus prevented, and the hemorrhage increased through acceleration of the circulation. If he were allowed to remain in the recumbent position, the coagulum which nature provides would prove an obstacle to the further loss of blood. Were a little useful knowledge of this kind more generally diffused, what a multitude of lives in the aggregate might be saved!

It is true, notwithstanding all that has been done by the very admirable surgical and sanitary departments of our immense army, that many soldiers still perish on the field of battle from hemorrhage, or are so much reduced as to preclude their subsequent recovery. Humanity and patriotism are deploring, with more than ordinary sorrow, this waste of precious human life; and I have thought that if some means were taken to disseminate among the officers and men a little rudimentary knowledge of where to apply constriction to the limbs for arresting hemor-

rhage from wounds, and perhaps to provide them with some simple and cheap means of doing this, no injury could result to any person, and this great cause of mortality might be to some extent diminished.

Of the various forms of death, that by hemorrhage is, to our natural instincts, one of the most appalling. The associations are all of them revolting—suggestive of the shambles. The glaze of the eye, the ashen hue of the countenance, the cold, dewy perspiration, and, withal, the nauseous odor of gore, are sufficient to carry an instinctive shudder to the stoutest heart. To these is added the pain of the wound, and, as long as that wound remains open and ready to bleed, though reaction may come on and restore the sufferer to consciousness and life, it is only to experience again the same horrors, the agonies of successive deaths, until nature fails, and the imprisoned spirit takes its final flight.

My heart sinks to think how many of our noble volunteers have passed through these portals in the dark and chilly night after the battle, with no friend near to aid or even pity them, yet fearlessly and bravely have passed through into the regions of immortality beyond!

The means of arresting hemorrhage, before the introduction of the practice of tying arteries by the celebrated Paré, in the fore part of the sixteenth century, were of the most rude and cruel kind, such as

the actual cautery with red-hot iron, and the application of boiling pitch to the bleeding surface. It is certain that this great and good man could have had no idea of the circulation of the blood; how it goes out from the heart to the extremities in throbbing arteries, which hold their course deep within the flesh along the bones; and how, to complete the circuit, it returns in the more superficial blue and pulseless veins; for all this was discovered by Harvey at a later period. But without this knowledge, Paré, inspired with the progressive spirit of true genius, ventured to apply a ligature to the point from which the spirting jet issued, and the success of his method proved perfect. By it he secured all the advantages of the old practice with hæmostatics, without their cruelty, uncertainty, and incompetency. He made a great advance in surgical art, and, so great did his fame become, that his presence was sufficient to inspirit desponding armies. At one time, when the garrison of a beleaguered city were about to surrender, it became known to them that this great surgeon was among them, and the fact encouraged the soldiers to such continued resistance as in the event proved successful—so much did these soldiers fear death from hemorrhage, and so great was their confidence in the power of this man to staunch the flow of blood. Of a like nature is the influence of every surgeon on the men placed in his care, and in this way is the sur-

geon one of the most important of officers in sustaining the *morale* of a force.

It is a mistake to assume that there is little or no danger of hemorrhage from gunshot wounds. Wounds of the large arteries of the legs and arms from balls and fragments of shells, punctured or incised, always bleed more or less at the time of reception, and more freely as the shock to the nervous system passes off and reaction comes on. Even where this nervous shock is not sufficient to produce immediate death, the chances for ultimate recovery most frequently turn on the mere question of loss of blood. Surely, then, any knowledge which it is possible to impart to the officers and men, which will be of service to them in that critical moment, when the wound is received, and no surgeon is present to give them attention, should be freely bestowed.

In the progress of the present war, cases are continually occurring which exemplify too plainly the truth of these remarks. At Antietam two young brothers stood side by side in the ranks of our army, and together bravely fell, the one pierced by a Minie ball through the lungs, and the other wounded in the thigh by a fragment of shell. He who was shot through the lungs still survives to reveal the horrors of the ensuing night, and relate the story of the tragic death of his brother, who was wounded in the thigh, by repeated hemorrhages from the femoral artery, which the two together were unable to con-

trol. When the survivor recounted to me the experience of that fatal night, and told me how his brother bled, and fainted, and rallied, and bled, and fainted, and rallied again, his bosom overflowed with grief, and his eyes became suffused with tears. But his bitterest sorrow was because he knew that, with the proper means, he might have arrested the hemorrhage, and thus given his brother a chance for his life.

Such instances as these are not isolated, but are continually occurring. In another case which came to my knowledge, the inside of the arm was torn away by a shell, and the man died during the following night from loss of blood while lying on the field of battle. Even as this paper is being prepared, the second officer of one of our vessels of war has fallen a victim to hemorrhage from the loss of a leg below the knee by a cannon shot, which hemorrhage occurred while removing him from the deck to the cabin of the vessel. Nor does there seem to be anything wonderful in this, when we remember that the whole circuit of the circulation is performed in but a few minutes.

Of the different methods of arresting hemorrhrge which have had their place in history, such as the use of hæmostatics, charms, and liquids that would decompose the blood, none of them are worthy of notice when compared with the grand principle of stopping the effusion of blood by mechanical constric-

tion of the artery which supplies that fluid—constriction either in the wound itself or at some part between the wound and the heart.

All the anatomical knowledge which is strictly necessary for effecting such compression may be acquired by both officers and men from the accompanying diagrams; and this knowledge is of such a nature that I think it may be readily understood, and will not be easily forgotten.

We must remember that each limb, be it an arm or leg, is supplied with blood by one main artery, which pulsates like that of the wrist, and whose pulsation may be felt in the same way that the pulse is felt at the wrist, when we use sufficient force with the fingers to press the artery down upon the bone in any part of its course. In this way it is that the supply of blood to the limbs may be at any time summarily stopped, and, as a consequence, bleeding of wounds of the arms and legs speedily arrested. As there is but one great arterial blood-vessel in the arm above the elbow, and but one of account in the thigh above the knee, it is most convenient to arrest the supply of blood to the limbs by applying the constriction at some point of the thigh or upper arm, even though the wound from which the hemorrhage occurs should be of the foot or hand.

For these reasons also, it is only necessary to call the attention of the officers and men to the relative positions of the artery and the bone in these two

regions, that is, in the upper arm and in the thigh, to enable them to understand and put in practice in case of necessity the tourniquet, one of the greatest inventions of modern times. I would especially advise captains and lieutenants of companies to make themselves familiar with the practice of arresting the circulation in these two regions by practicing at their leisure upon themselves and on the men.

The elements of anatomical science should be more diffused among the people. So little is this kind of knowledge generally known, that a captain of the army of the Potomac with whom I was lately conversing, expressed surprise when I informed him that the main artery of the lower limb passed down in front along the groin, as he had always supposed it to be somewhere in the back part of the limb. At my request, in the sitting position as he was, he placed the ball of his thumb on the upper part of his groin, and, bearing firmly down, compressed the artery upon the bone beneath it, until he stopped its pulsations; thus gaining knowledge which may yet be of the greatest service to him, and knowledge of which I would that every soldier of my country, who is liable to die by hemorrhage on the battle-field, might be possessed. It was by possessing such knowledge as this, that an intimate and valued friend of mine, a distinguished British officer, was able to save his own life. He had lost a leg below the knee, from a cannon-shot, and was bleeding profusely, but suc-

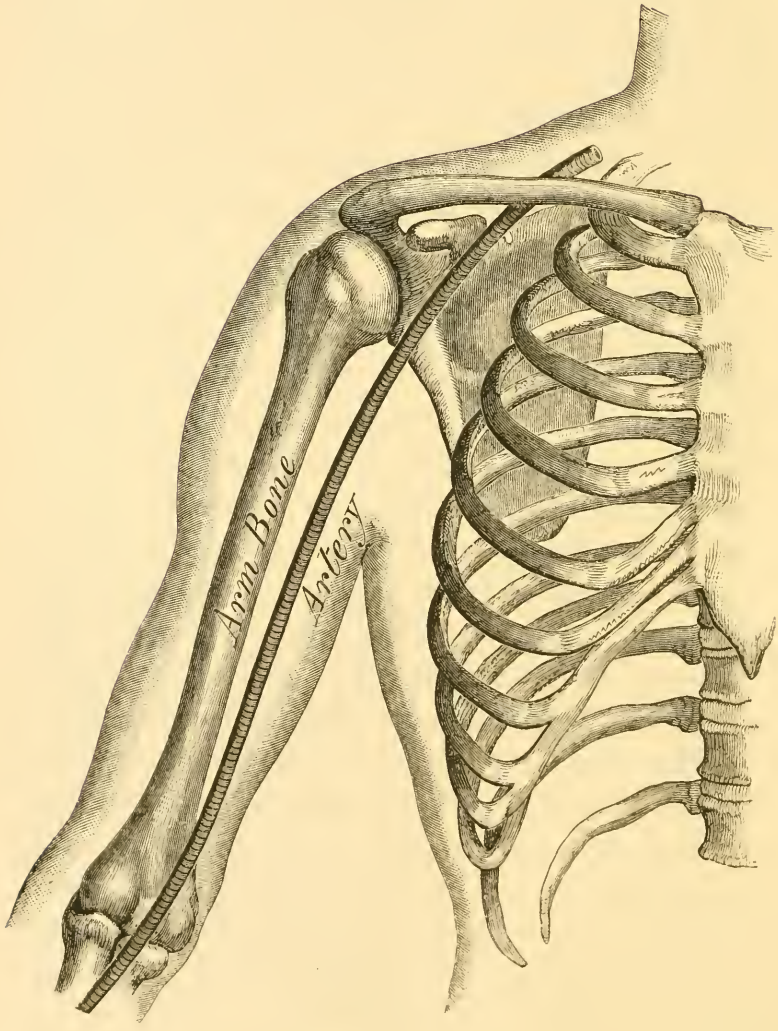
ceeded in binding his sash so tightly about the stump as to arrest the flow.

By reference to the first diagram, it will be seen that the great artery which supplies the arm with blood passes out from the chest under the collar-bone, and over the first rib. At the crossing of the artery over the first rib, surgeons, when about to amputate at the shoulder-joint, arrest the circulation, by pressing down upon the artery from above and behind the collar-bone, at about its center, with some smooth flat substance which will readily indent the flesh, such as the ring of a door-key. But it is hardly to be supposed that unprofessional persons without experience should succeed at this obscure point; and, as bleeding from wounds in the armpit is the only accident to which this treatment is ever applied, I will rather presume the process to be impracticable to the uninitiated, and direct the wound itself to be immediately filled with some substance, such as a portion of the shirt or other clothing, and constriction applied directly to the source of the flow.

The highest point of the arm then to which we will consider the tourniquet applicable, is the axilla or armpit, and here it is to be applied with the pad directly over the wound, with or without other filling, and tightened over the top of the shoulder until the hemorrhage is arrested.

By referring to the diagram again, we shall see that the artery, after leaving the armpit, passes

Diagram 1.



down along the inner side of the arm, winding forward, until at the bend of the elbow we find it occupying the center of the front of the arm, directly under the veins where the operation of blood-letting is usually performed, which is the lowest limit of the region for the application of the tourniquet in the superior extremity. Here the pulsation of the artery may be readily felt in the human body by pressing upon it with the points of the fingers.

If we divest the superior extremity of clothing, and lay a piece of twine with one end over the middle of the collar-bone, and the other over the center of the space in front of the elbow, this line will mark out the position of the brachial artery; and in thin persons pulsation may be felt along its whole course. The pad of the tourniquet may be applied to any portion of this line, and, when sufficient pressure is made, the artery will be forced down upon the bone, and the circulation controlled, which will be indicated by the suppression of the pulse at the wrist.

It is better to apply the tourniquet above the elbow, even in wounds of the hand or forearm, as the artery divides at the elbow, and its branches are also more protected from the proper pressure of the instrument by the presence of two bones. But if the hemorrhage still continue after the application of the tourniquet to the upper part of the arm, I would fill the wound and apply pressure immediately to the bleeding surface.

The second diagram is intended to show the course of the great artery of the thigh from the center of the groin, where it leaves the cavity of the abdomen, down to the center of the hollow space behind the knee. The pulsation of this artery in the groin may be distinctly felt with the fingers or ball of the thumb, when the thigh is bent toward the body, by pressing in the groin about half way between the point of the hip-bone and the center of the body. The pressure must be sufficient to reach the bone beneath, and varied a little along the course of the bone, until the artery is detected. This is the highest position in the inferior extremity to which the tourniquet can be applied in wounds of the groin, and in such cases it is generally necessary, from the profuse hemorrhage, also to stuff the wound. I would do all that was possible by either or both methods to stop the loss of blood. Where the wound is very high, the band of the tourniquet may be allowed to pass around the hips, placing the pad over the stuffing of the wound. No harm can come from the trial, though it is very difficult to control the artery by any instrumental means at this point.

The lowest point of the inferior extremity to which it is customary to apply the tourniquet, is the popliteal space behind the knee. If the leg be bent nearly to the thigh, and the ends of the fingers pressed between the two lines of the cords, in the space behind the knee, so as to bear upon the bone,

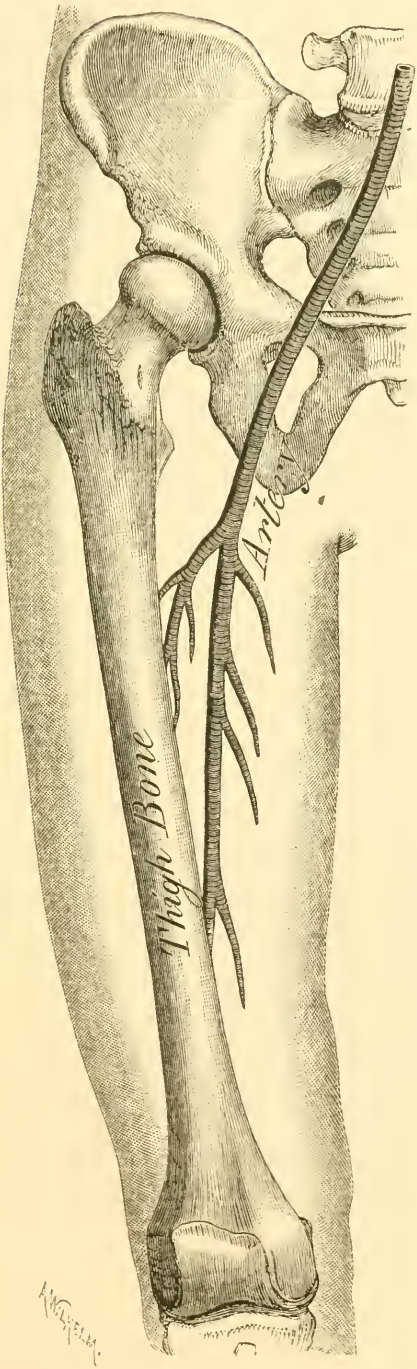


Diagram 2.

the pulsation of the artery will be distinctly felt at this point, and by sufficient force may be arrested. In fact, this is one of the most convenient places for applying the tourniquet when we are allowed our choice, as the broad extremity of the thigh-bone forms an admirable support, and the hollow space secures a fixed position of the pad.

Having discovered the artery then at these two points, namely, near the center of the groin above, and in the center of the space behind the knee below, it only remains to join the two by a line which will pass from the pubic bone down along the inside of the thigh-bone, gradually winding backward until it is directly behind at the knee. The pulsations of the artery may be easily detected through this entire route in thin persons, but its path is not so readily discovered as that of the main artery of the arm.

To any portion of this region the tourniquet may be applied with the pad over the artery, and sufficient pressure will arrest the current of the circulation, and prevent bleeding from a wound below. If the location of the wound should be such as to allow us a choice of places, it is customary to prefer a point about one-third of the way from the knee, as the artery is here more close to the bone.

To wounds penetrating the three great cavities of the body, that is of the chest, head, and abdomen, the tourniquet is not applicable. Such wounds should be left open for the escape of blood, as the accumula-

tion of clots in either of these cavities soon leads to fatal results. Hence all the anatomical knowledge that is requisite for the successful use of the tourniquet, is in fact conveyed in what has been said of the regions of the upper arm and thigh.

Having this knowledge, any person on the field of battle may pick up a stone of the size of a hen's egg, and place it over the main artery of the arm, secure it by tying with a handkerchief or sash, and exert pressure by passing a bit of stick through over the stone, and taking a turn or two until the pulsation at the wrist ceases, or the bleeding is controlled. And the same may be effected in the inferior extremity by the same means, using of course if convenient a stone somewhat larger for the pad, and feeling just back of the inner ankle for the pulse to determine when the circulation is controlled.

In the most primitive form of tourniquet the band made two turns around the limb, and was knotted over the artery. The stone was placed under the inner turn of the band, while the stick was passed through under the outer turn only, that is, under the knot and over the stone. The arrangement was then tightened by twisting with the stick. In another form the stone was inclosed in the center of a shawl or large handkerchief, which was folded diagonally and passed twice around the limb, and the free corners then knotted over the stone. Torsion was then made with a stick.

In the early part of the last century, Pétit, a French surgeon, improved these simple devices by adding a screw, with which to force the pad down upon the artery, thus giving to the instrument the form in which it is now most frequently used. In his tourniquet, the apparatus for tightening the band consists of two plates, which are placed over the artery and separated by means of a screw.

Since the time of Pétit, there have been suggested various modifications in the form of the instrument, such as making the band of a hoop of iron or brass, to relieve from pressure the sides of the limb; giving the threads of the screw a steep inclination, to secure rapidity of action; or making the threads of the screw to wind in opposite directions on different portions of the same spindle, to attain the same result: but, in the main features, all these instruments are essentially the same.

But, however desirable the screw and plates may be as an apparatus for tightening the band, they are not always to be obtained. Their weight and bulk and complicated nature operate to prevent their presence on the field of battle, and thus to limit their use to the practice of medical men.

And the objection to the French tourniquet is, that its application requires the assistance of a second person, while, for military and naval purposes, the instrument which can be applied by the wounded man himself must ever have the preference.

Diagram 3.

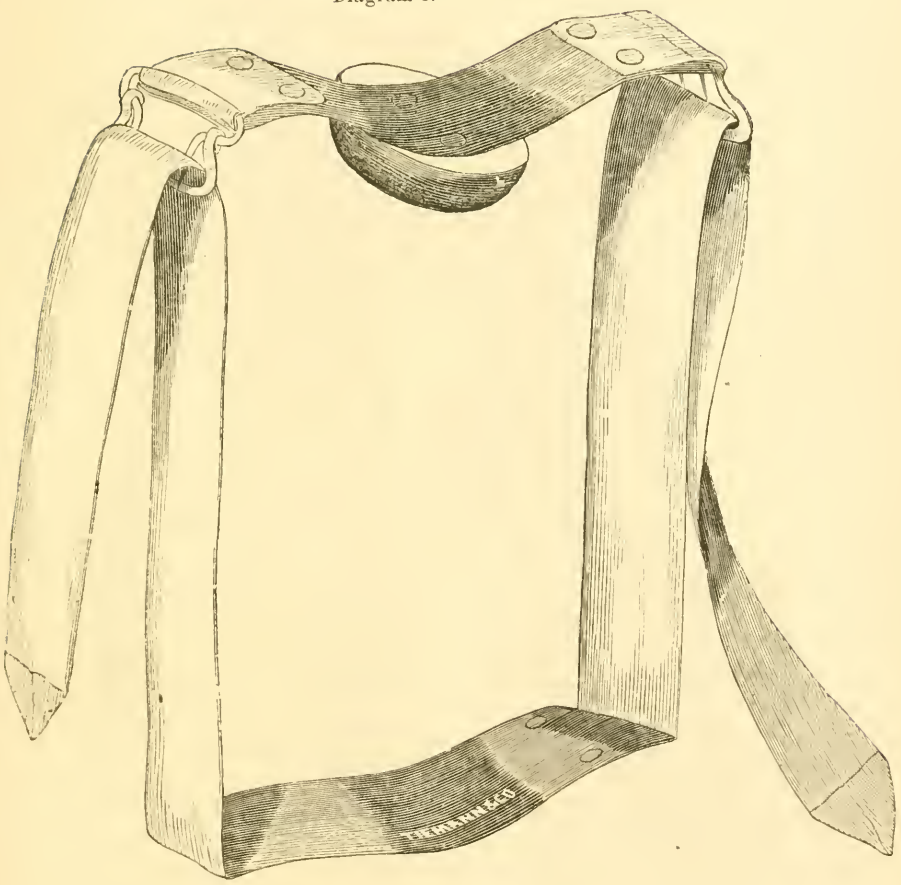
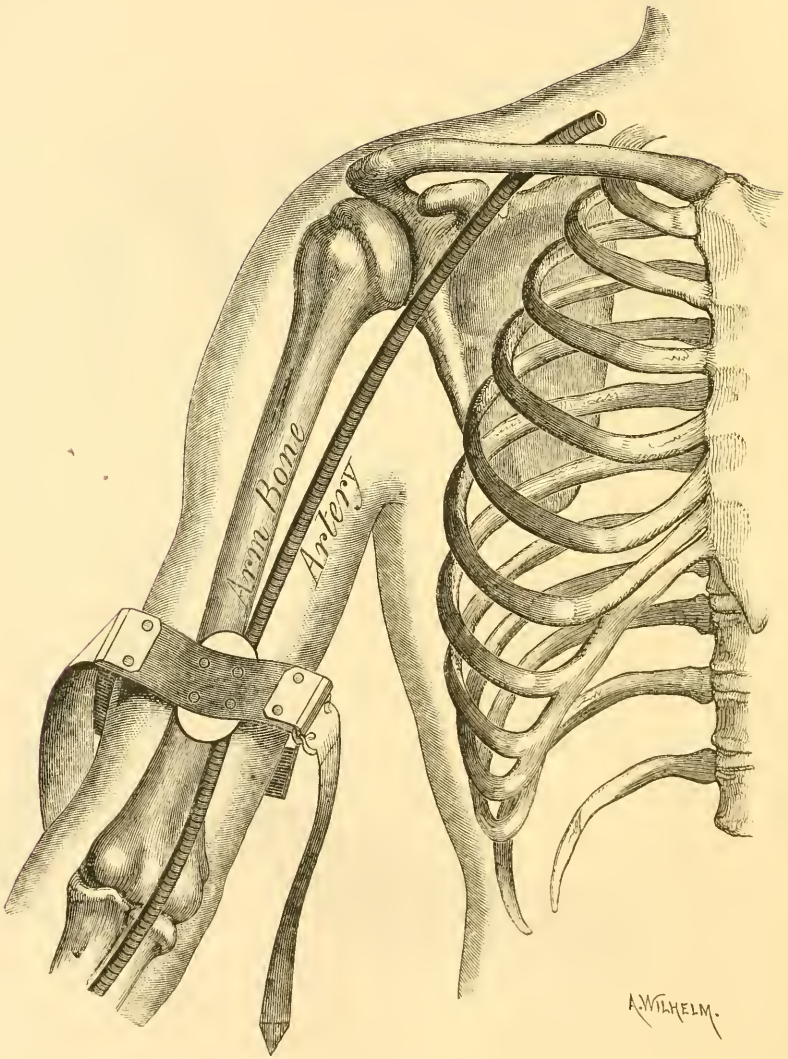


Diagram 4.



To meet these special requirements, a number of instruments have been contrived in different countries. That of Dr. Lambert, of this country, is very good; but the one invented by my son, Dr. Alexander B. Mott, is more simple in construction, more neat, and compact, and portable, and is the one we prefer. It is eminently fitted for military and naval practice, and well adapted to the walks of private life.

One great excellence of this instrument is, that it can be applied by the wounded man himself. Its cheapness is another of its good qualities, as the cost will not exceed fifty cents; thus placing it within the reach of every private soldier as well as every officer in the army, who may desire its protection.

Diagrams Nos. 3 and 4 represent this instrument and illustrate its modes of application.*

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* The following letter from my son gives a full account of the construction of this instrument and its application:—

209 Tenth Street, New York, May 24th, 1863.

Dear Father:—Believing that the tourniquet which I send you has numerous advantages over all other instruments of the kind now in use, I beg you will give it a trial, and if it meet your approval it will afford me pleasure to see it adopted by you, and recommended to the profession.

As you will notice, its construction is very simple, and its application not complicated—it can easily be repaired by any ordinary mechanic.

Another good quality which it possesses is, that it may be cleansed with water, without fear of rust or injury to any of its

Before closing this article, perhaps it may be proper to say that some objections have been urged to the general use of the tourniquet by unprofessional per-

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component parts. It is composed of steel plates, the anterior one 5½ inches long, having a wooden pad (grooved or smooth) permanently attached transversely to its center by two (2) screws, the ends of the plates thrown up from the center so as to form wings, and having attached to either end ordinary buckles secured by copper rivets through a piece of webbing.

The posterior plate, 5½ to 5 inches long, is of the same material and somewhat of the same shape, having but one point of pressure, the center; at each extremity is riveted a piece of webbing 12 inches long.

The mode of application I believe would present itself to the mind of any casual observer, and therefore needs but little explanation.

Either strap is to be passed around the limb (arm or leg) and through the buckles, thus securing it, care being taken to place the posterior plate on the opposite side of the limb to the anterior one; the wooden pad is then to be placed over the artery to be compressed, and either or both straps drawn sufficiently tight to obstruct the current of blood through the vessel.

Having furnished a sample of this tourniquet about two months since to Brigadier-General W. A. Hammond, Surgeon-General U. S. Army, I am happy to say that it met with his approval, and I trust will find its way into the army, as I believe it fulfills all the requirements of a field tourniquet, being portable, less complicated than any now in use, and readily applied with one hand by a wounded soldier upon himself.

I likewise claim for it the important advantage of arresting hemorrhage in cases of wounds of arteries, without interrupting the collateral circulation in the limb to which it may be applied;

sons. It is alleged that the instrument might be placed on the wrong side of the wound, and in this way do more harm than good. But this objection answers itself, as the most ignorant operator would immediately change the position of the instrument when he found the hemorrhage increased.

Another objection which we more frequently hear is, that a swelled or puffy condition of the limb is produced by the constriction of the tourniquet when long applied, rendering it more difficult for the surgeon to perform the subsequent operations of amputation or the securing of vessels. But we must remember that in most cases the subsequent operations will eventually be performed above the wound, and so also above the tourniquet, where swelling and infiltration do not occur. But this objection also answers itself in a practical way, for some sort of constriction will probably be applied, as there are no men who would prefer to bleed to death rather than impose a difficult operation on the surgeon.

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thus allowing reaction to take place, and the removal from the field, of wounded, for many miles before surgical interference is necessary.

This instrument was made under my direction by Messrs. Tieman & Co. of this city.

Your affectionate son,

ALEX. B. MOTT, M.D.,

Prof. of Surgical Anatomy, and Surgeon U. S. Vols.

Prof. Valentine Mott, M.D., New York.

A third objection, and one which appears at first sight more plausible than those just mentioned, is, that mortification and the death of the limb would be induced by leaving the tourniquet too long in position. But I cannot conceive of any military necessity for keeping the circulation suppressed by the tourniquet more than an hour or two; and yet I have seen the circulation as completely abrogated as it can be by means of this instrument for a number of hours at a time without unfavorable results. Nor have I, in any case of practice, judicious or injudicious, ever seen any bad effects follow the continued application of the tourniquet that could be fairly and truly attributed to that instrument. It is true that many of the severely wounded, after some days, will die of typhoid symptoms, which are attributed to phlebitis and pyæmia, but I choose rather to perceive the primary cause of death in such cases to be very generally an excessive loss of blood at the time of receiving the wound, or the repeated occurrence of secondary hemorrhage.

But if all these objections were cogent and true, they amount to nothing when brought into conflict with that great law of the medical profession, which directs and determines all our art, namely, to prolong life for any time, however short, by any means, however expensive. "*Sire*," said the great Baron Larrey, with unswerving integrity, to the first Napoleon on a memorable occasion, at the siege of Jaffa, "*it is my*

avocation to prolong human life, and not to destroy it." So, in any case of serious hemorrhage, contingencies, remote and uncertain, are not to be taken into the account, but the urgent necessities of the moment are to be met at once, by measures the most convenient and effective. Even in those cases where ultimate death is inevitable, it is better to prolong life for a time than to see the patient helplessly perish in our hands; and I believe that, in any case of hemorrhage, it is better to suffer the temporary evils of the tourniquet than to permit any serious loss of blood and consequent shock to the nervous system.

Many of the low forms of fever that prevail in hospitals have their origin in the debility which has been produced by hemorrhage from wounds. The immediate effects of loss of blood upon the nervous system are very apparent in that suspension of the faculties of the mind which is known as fainting, and from which the persons, in most cases, soon recover. But where hemorrhage is excessive in the first instance, or frequently recurs, a permanent affection of the nervous system is induced, indicated by a fluttering pulse, pain in the head, flushed face, ringing in the ears, irritability of the stomach, and other symptoms of typhoid fever.

It is to the nervous system that we must look for any explanation of the intermitting and remitting character of fevers, or even those slight remissions that attend fevers in their most continued forms;

for the nervous system is the only system in which regular remissions constantly recur. I believe that the lesions that are now discovered after death from fevers, are rather the effects than the cause of the disease; and that if we shall ever become able to inspect the nervous system in the same clear and conclusive way that we now examine other organs of the body in post-mortem cases, this doctrine will be conclusively established. In diseases of the brain, depletion affects the nervous system more promptly than any other agent; and in the same way excessive loss of blood produces those low forms of typhoid disease which have their origin and seat in the nervous system. Let the tourniquet then be applied, to prevent the subsequent occurrence of pyæmia and typhoid fever.

There is another advantage which would be gained by the general introduction of the tourniquet among the troops, which is too important to pass unnoticed. It is the moral courage and confidence which the possession of this instrument would give the soldiers. We have seen that in some cases men dread the manner of death more than death itself, and that, in general, death by hemorrhage is regarded with most horror. We have seen that it was by possessing the power to control hemorrhage, that Paré infused a brave spirit into the French troops. So the possession of a tourniquet by any soldier who feels competent to use it, supports his courage, and he feels

that if wounded in the service of his country, his blood will not be needlessly wasted. In this way slight material causes frequently give rise to extensive moral and political results, and I hope this simple instrument, which I recommend, may not only save the lives of many individual soldiers, but, by increasing the confidence of the troops, in some measure may contribute to the final success of our arms; and it is with these views that I have devoted the necessary time and labor to the production of this monograph, though at a period of life when men naturally incline toward repose.

But in this great struggle whatever is left of my days is at the disposal of my country, whether it be with the sword, or with the knife, or with the pen—on the field of battle, in the hospital, or at home.

The lapse of years is beginning to admonish me, that what more I have to say or do for my fellowmen must be said or done quickly. And if the exigencies of this conflict should require it, I am ready not only to sustain our army with words of fortitude and hope, but again to don the harness, and make one more campaign of active service in the cause of my country, and devote to her whatever remains of the autumn of my life with its autumnal fruits.

TREATMENT OF FRACTURES

IN

MILITARY SURGERY.

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IN

MILITARY SURGERY.

In military practice, peculiar difficulties are apt to exist in the treatment of fractures; so that the surgeon is sometimes obliged to amputate limbs which he might in civil life hope to save. These difficulties arise either from the want of suitable or adequate apparatus, or from the unfavorable conditions of the case; as on the field of battle, on the march, or wherever the patient must be transported any distance before finding the rest and quiet so essential to his comfort or even safety. It has therefore been thought by the Sanitary Commission that some hints upon this branch of surgery, and especially upon the expedients which may be resorted to in emergencies, might prove useful to those engaged in the army medical service.

MATERIALS FOR SPLINTS, ETC.

A supply of heavy pasteboard, or binder's board, will be found of great value for making splints. It

may be cut into strips eighteen inches long and six wide; there should also be a dozen or more pieces of twice this width, for making angular arm-splints. Paper of any kind, but the stouter the better, folded to give it sufficient firmness, may be substituted in many cases, when pasteboard cannot be had. Wide straps of thick leather, or even strips of the bark of certain trees, will often answer.

The pasteboard, first softened in hot water, is moulded to the injured part, and confined in its place by means either of bandages or of adhesive plaster. Cold water will soften it, but not so well as hot; it may be bent without either, but is not then very manageable, and moreover is apt to break.

Bandages ought never to be applied directly to a fractured limb at first, except in special cases, as for instance when the patella or the olecranon is the seat of injury. This rule is particularly imperative where the surgeon is obliged to send the patient away from his immediate oversight, since irreparable mischief from constriction of the swollen limb may have ensued before it is examined by another medical officer.

Splints should never be too small. If flat, they should be wider than the broken limb, so that a triangular space is necessarily left between the splint and the bandage on either side of the limb. In recent cases, where swelling is to be looked for, this is a matter of importance. Shaped splints should never surround the limb more than one-third, and there

should always be a layer of some yielding substance, such as cotton batting or folded flannel, tow, or bags stuffed with bran, chaff, sand, sawdust, dried leaves, or fine hay, between any splint and the skin.

Splints should never be too short. The whole of the broken bone needs support, and in order to this the joints at either end must be secured as far as possible at perfect rest. Nothing is more essential to safety and comfort during transportation than attention to this point; and the only safe rule is to aim at supporting the entire limb.

Wooden splints are somewhat less easily attainable in military than in civil practice. If flat, they may be made to fit better by conforming their outlines to those of the injured limb; it is sometimes well also to cut holes, with carefully rounded edges, for the reception of bony prominences, such as the condyles of the humerus. Tin splints are highly spoken of by some authors; the only disadvantage they have is that they cannot be so accurately adapted to the part as pasteboard, unless the sheets are selected especially on account of their thinness, and then they would be apt not to be firm enough.

An excellent plan for putting up fractures of the extremities, in an emergency, may almost always be adopted; it is only strange that it is so little known. This is to take a bundle of straw, the stiffer the better, (wheat straw is the best,) and to inclose the limb in it, the component straws lying parallel to the axis

of the limb. The latter and its envelope may then be bound round with wisps of straw, strings, bandages, or any convenient article, care being taken not to compress the seat of fracture too strongly. Greater firmness may be given by inserting two or more sticks among the straws at either side of the limb. Should swelling now occur, the dressing will yield, the straws being simply drawn out in the direction of their length. The state of the parts may be readily watched; hemorrhage will be at once manifest; and when the dressing is to be removed, we have only to loosen the circular bands. Extension and counter-extension may be made in various ways, upon a limb thus done up. When suitable straw is not to be had, hay, the stems of bushes, corn-stalks or leaves, cane-stalks, twigs, or small sticks may be substituted. Almost any fracture of the extremities can be thus arranged so as to be comfortable, even if the patient has to be transported some distance. And in those rare cases in which the bones of the trunk are broken, either on the march or in the field, the whole body may be incased in the same way, a much larger bulk of straw being of course required.

In some countries, the custom prevails of placing broken limbs in a mould of wet clay, which dries into a very solid case. This might be resorted to temporarily, in the absence of all other appliances, but has the disadvantages of weight and liability to crack.

Wire has of late years been extensively employed for the construction of splints. It may be provided in the form of a fine net-work, in rolls, to be cut in the figure wanted for use; or coarse wire may be carried in coils, pieces being cut off and bent into shape when required. The latter is generally made into a frame, on the under side of which the limb is, as it were, suspended in the turns of a bandage.

At a somewhat advanced stage of the treatment, the danger of swelling is past, and the patient is usually placed under more favorable circumstances for the employment of the immovable apparatus, in some one of its forms. The best of these is perhaps the plaster of Paris splint or bandage; the splint being made by dipping coarse old washed muslin, previously cut and folded to the proper shape, in plaster mixed with cold or hot water, and the bandage by rubbing in dry plaster into the meshes of an ordinary roller, which is moistened as it is applied. None but the best finely ground plaster should be used; its setting or hardening is quickened by the addition of a little salt, delayed by that of a few drops of mucilage. Some surgeons apply the plaster to the naked skin, previously greased. Another form of moulded splint may be made by folding old flannel, and saturating the outer thickness of it with shellac or varnish of some kind. Felt is used by many surgeons in preference to any other material for making splints. Starched and dextrinated band-

ages have fallen somewhat into disuse of late years, the slowness with which they harden rendering them particularly unsuitable for employment in military practice.

We decidedly recommend immediate reduction whenever it is at all practicable. It is not true that the parts remain wholly inactive for eight or ten days, for swelling occurs by effusion of lymph and congestion, and the muscles shorten; so that it may be extremely difficult at the end of that time to bring the fragments into place.

In all cases of doubtful diagnosis, as when the injury is near the hip-joint, it is better to etherize the patient thoroughly, so as to relax the muscles, and render the examination of the part not only less painful, but more satisfactory to the surgeon.

COMPOUND FRACTURES.

The compound fractures met with by the army surgeon are in a very large majority of cases the result of gunshot; and the improvements in modern fire-arms have given these injuries a much more uniformly serious character than they formerly had. It is very seldom the case now that a ball touches a bone without shattering it; and this does not involve the necessity of a large wound of either the skin or the periosteum,—a fact which modifies not only the diagnosis, but the course and prognosis of gunshot fractures.

When amputation is not at once called for, (a matter elsewhere discussed,) the surgeon's great object should be *to change the compound fracture into a simple one.*

Hence *the wound must be cleansed* of all dirt, foreign bodies, balls, bits of clothing, or loose splinters of bone. With regard to these latter, all the best authorities, Malgaigne, Baudens, Macleod, Bryant, Longmore, agree that they ought to be diligently sought for and removed. Dupuytren classified them into—

1. Primary, completely detached by the injury itself.

2. Secondary, so slightly retained by periosteum as to become loose when inflammation is set up.

3. Tertiary, liable to subsequent necrosis.

The latter, from their size, shape, or situation, may have to be left in place for a time; the two former should always be extracted as early as possible. The surgeon must use his best judgment in distinguishing between the different forms of splinters.

Hemorrhage should be completely checked, by the ligation of the main artery of the limb, if it cannot be done otherwise.

Resection of the ends of the fragments is sometimes necessary, when they project through the wound, or have forced their way through the skin, and cannot be reduced. The sawing should be done obliquely, and in such a way as to favor the accurate fitting together of the cut surfaces. Much trouble from

spasm and tension of the muscles is thus obviated, especially when the patient has to undergo transportation.

Sutures can only be used in very rare cases, when the wound is a large and clean one; and they should always be amply supported, unless the patient can be kept under the surgeon's eye, by adhesive strips.

Bandages ought never to be applied to compound fractures on the field; the best plan is to put the part up in a bundle of straw, with or without extension, or to fasten it to a splint of some kind with broad adhesive strips. In the later stages of the treatment, when there is less hurry, and more conveniences are at hand, the bandage of Scultetus may often be usefully employed; it consists of strips of muslin, whose length is about one-third more than the circumference of the limb, laid so as to overlap one another by about one-third, and then brought up so as to surround the part. The chief use of this is to make slight compression, and to retain dressings; it has the advantage that any of its constituent strips, when soiled, may be easily withdrawn, a fresh strip being pinned to one end of the soiled one so as to be put in place at once without disturbing the limb.

Extension is always a matter of more or less importance, and sometimes suffices of itself to keep a broken limb in comfort. It is easily made with adhesive plaster, a handkerchief, a wisp of straw, or a piece of bandage. Sometimes it is well to recollect

that the patient's boot or shoe need not of necessity be taken off in order to apply the extending band. Counter-extension may be made by handkerchiefs or any other convenient means. When the patient must undergo transportation, it is almost always better to fasten the extending and counter-extending bands to fixed points in the litter or bed, or on the floor of the wagon; pegs being driven for this purpose if necessary.

There is, however, one case in which continued extension may do harm, if made too powerfully; it is when a considerable loss of the substance of the bone has occurred, so that the fragments need rather to be held together than to be drawn apart.

The *dressings* most suitable in these cases are composed merely of lint or soft old rags wet with cold water, lightly confined in place. If the surgeon has to send the patient away from his constant oversight, warm-water dressings, covered with oiled silk, or some other impervious material, are likely to be comfortable for a much longer time than cold, which require moistening as evaporation takes place.

Ice or ice-cold water has been highly spoken of, particularly by Prof. Esmarch, of Kiel, as a local application in compound fractures as well as in other injuries. A trial of it is recommended.

When suppuration is set up, the surgeon must provide some means of soaking up the discharge; and there is nothing better for this purpose than ordinary

bran. It was, indeed, proposed by Dr. J. R. Barton to dress compound fractures simply by imbedding them and covering them over with bran.

A very annoying and disgusting circumstance, which sometimes takes place in compound fractures, is the development of maggots in the wound. This can only be prevented by keeping the part covered so that flies cannot get at it to lay their eggs. The maggots can be destroyed by lye-washes, or by diluted solution of chlorinated soda.

SPECIAL FRACTURES.

Fractures of the Lower Jaw.—These are best treated by means of the bandage described by Dr. Barton, and known by his name. (See cut.) Another and

simpler plan is to slit up a bandage, 3 inches wide and a yard in length, from either end to within 3 inches of the center; which being applied over the jaw, the two tails on either side are crossed over one

another, and the corresponding ones tied at the top and back of the head respectively. A cap of pasteboard, folded paper, or even plaster of Paris, should first be fitted to the chin. If time permit, the coaptation of the fragments may be further insured by inclosing the teeth adjoining the injury in a loop of fine wire, tightened by twisting its free ends together. The extraction of a tooth is seldom if ever necessary to enable the patient to take food.

Fractures of the Clavicle.—In these we must often be content with simply suspending the arm in a sling, made or folded into a triangular shape, the apex being pinned or sewed up so as to bring the elbow as far as possible across the front of the chest. The best bandage is Velpeau's, particularly when the patient has to be transported; it is so little known in this country that a description of it may be useful. The hand of the injured side being brought up so as to rest upon the sound shoulder, a roller 2½ inches in width is applied, beginning in the sound axilla, passing across the back to the injured shoulder, down in front of the arm, under the elbow, up behind, and over the shoulder, and down across the front of the chest to the original point of starting. This having been several times repeated, turns of the bandage are made horizontally around the body and the arm of the injured side, from below upward, until only the hand and the tip of the shoulder are left uncovered.

The arm is thus bound to the trunk, and the whole is secured by inserting pins wherever the turns of the bandage cross one another.

Whenever it is practicable to place the patient permanently on his back, the deformity in fractures of the collar-bone will be found much lessened, or almost entirely corrected.

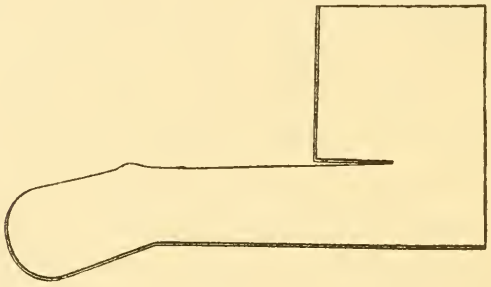
Fractures of the Ribs and Sternum.—These call simply for pressure on the walls of the chest; which may be made either by applying broad strips of adhesive plaster, *first stretched*, covering in the point of injury and several inches on every side of it, by surrounding the chest with firm turns of a broad bandage, or by any other constricting means which may be at hand. Compresses judiciously arranged are sometimes of great use in bringing the pressure to bear upon the exact points needing it.

Fractures of the Humerus must be differently treated according to the point at which the bone may have been broken. But it must always be remembered that from the form of the limb the leverage on the fragments is very great, so that the whole member must be well supported. Shortening must be carefully obviated when the line of division is oblique.

Angular splints of wood or pasteboard answer the end best; if these cannot be obtained, a mould of clay or of plaster of Paris may be used, or the straw previously described, as a temporary resource.

In making an angular splint, the part intended for the upper arm should be left at least 10 or 12 inches long, so as to reach completely up into the axilla. When the fracture is very high up, the splint being cut to fit the inside of the arm and forearm, the elbow being at a right angle, a pasteboard cap should be adapted to the shoulder and upper half of the arm; and then, the limb being bound to the splint, the cap should be fixed in place by figure-of-8 turns around it, the body, and the axilla. The object of this is to confine the scapula, and through it the upper fragment. When the shaft is broken at any point in its length, either an inside or an anterior angular splint may be used, one, two, or three short pieces being placed on the arm so as to confine it still more closely. If the seat of fracture is low down, close to the condyles, or involving one or both of them, any lateral splint is apt to press the lower fragment out of place; and hence an anterior angular splint is preferred by many surgeons, its angle fitting across the bend of the elbow, and the forearm being in complete supination. But this posture is an unnatural one, and cannot be comfortably endured for any length of time. Hence it is better to combine the inside and anterior angular splints, by tacking a piece of pasteboard of the proper size and shape to the upper or arm portion of an ordinary wooden inside angular splint. Or, cutting out the whole from one piece of pasteboard, we may follow the outline of

the inside angular splint, but make the upper portion, above the angle, a little more than twice as wide as usual; and then, cutting a slit half way across it, continuous with the upper edge of the forearm part, we have a portion which may be bent over so as to fit the front of the arm. (See cut.) All these inside angular splints should have the part corresponding to



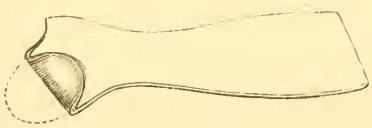
the hand cut at an obtuse angle with that for the forearm, so that the hand may be inclined toward its ulnar border; this will add greatly to the patient's comfort.

It is easy to see how the same purpose could be answered with a piece of stout wire, bent so as to form a frame for the limb, well wrapped in bandage, and secured like any other splint.

Extension and counter-extension, when a strong tendency to shortening exists, may be best made by means of a separate splint, applied first of all, and reaching along the back of the arm from above the shoulder to below the elbow, bands of adhesive plas-

ter being passed beneath the axilla to its upper end, and over the bend of the elbow to its lower.

Fractures of the Forearm.—The bones of the forearm are exactly on a plane with one another when the hand is in the semiprone posture, and at the same time none of the muscles are put upon the stretch; this is therefore the proper position to be given to the hand in all cases of fracture of the upper extremity. It is most effectually secured by means of an inside angular splint, similar to that for fracture of the humerus; the upper or arm part of such a splint not only preventing rotation of the hand, but serving to increase the steadiness of the broken bones. Narrow compresses, so arranged as to preserve the interosseous space, ought always to be employed. The forearm part of this splint may be made on the principle of that known by the name of its inventor, Dr. Bond;



its edges being cut to correspond with the outline of the forearm, and a block, a wad of paper, a mass of clay, plaster or wax, or a pad of tow, arranged so as to be grasped in the palm of the hand. If this block or pad is too large, it will simply bend the wrist backward. The same purpose may be answered, if the

splint is made of pasteboard, by cutting it long enough to reach the ends of the fingers, softening its end in water, and then doubling or rolling it backward. (See cut.)

Angular deformity is less likely to ensue in fractures of the ulna or of both bones near the middle, if a slip of leather or of pasteboard is tacked along the ulnar border of the splint, or by turning up this border if the splint is made of pasteboard.

Fractures of the *olecranon* are even rarer in military than in civil surgery; they are best treated by means of an anterior pasteboard splint, bent very slightly, and adhesive plaster directly applied so as to keep the fragment as nearly in place as possible.

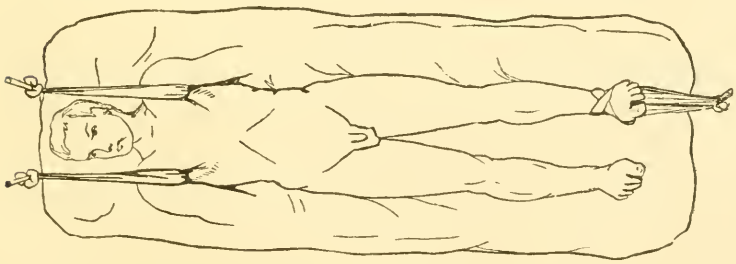
For fractures of the *metacarpal bones* or *phalanges*, a hand-splint should be used, with a block or pad as described above. In many cases, it is sufficient to close the hand over a ball of the proper size, securing it so by means of adhesive plaster.

Fractures of the *lower extremities* are especially difficult of management, on account of the size and weight of the parts involved, and the consequent trouble in fixing the fragments so as to prevent their rubbing against one another or tearing the adjacent soft tissues.

In the *thigh*, the bone being single and comparatively small, the muscles powerful, and the leverage

on the lower fragment great, it is very generally necessary to use some extending force from the outset. Sometimes, on the march or in the field, we must be content with the straw-splint described in Section I; but if possible, some form of extension should be added to this. Thus a board of proper length may be placed along the outer side of the limb, and a handkerchief folded cravat-wise passed around the perineum and tied to its upper end, while the foot is secured below in like manner. The extending band may in such a case be tied over the shoe or boot. Or the board may be placed along the inner side of the limb, its upper end carefully padded, bearing against the perineum.

Another plan, when the patient is to be transported in a vehicle, is to drive pegs into the floor of it at points corresponding with the axillæ, and others



a few inches beyond the soles of the feet; these pegs being long and strong enough to serve as points of attachment, the upper ones for the shoulders, the lower one for the feet, by means of wisps of straw,

handkerchiefs, bandages, or adhesive strips. (See cut.) Other pegs may be driven so as to be conveniently grasped by the hands of the patient. Whatever material is used for him to lie on, should be laid as evenly as possible; and the injured limb should be carefully and firmly wrapped in its own bundle of straw.

When time permits, and a few boards can be had, a very good plan is to have a box knocked together, consisting of a bottom and two sides. The outer side should be long enough to reach from 4 inches below the foot to the axilla, the inner one from the same point to the perineum; the bottom, smoothly beveled off above at its upper edge, should reach from the tuber ischii as far down as the other two. Counter-extension may be made from the perineum as in the ordinary Physick's apparatus, extension by any convenient band fastened to a peg driven either between the two sides, which is best, or vertically into the bottom of the box at its lower end. Straw, hay, sand, bran, cotton, tow, or even leaves, may be used to imbed the limb and prevent its contact with the wood.

In hospital, as a matter of course, the treatment may be as a general rule carried on much as in civil practice. Desault's apparatus, as modified by Physick, is widely and favorably known. Counter-extension may be made either with the stuffed tube of buckskin or muslin, the perineum being daily washed

with whisky, and *carefully dried before the band is reapplied*, or by means of adhesive plaster when an abundance of this material is at hand.

With regard to the extension, this is best made with adhesive plaster, in the following way: A strip 2 inches wide, and twice as long as from the seat of fracture to 3 inches below the sole of the foot, is stretched as much as possible. A bit of thin wood, 2 inches square, is next fitted to the middle of its adhesive surface, and on either side of this a small slit is cut lengthwise in the plaster. Through these two slits a strip of bandage is passed, so that the bit of wood is between the two strips. The adhesive band being now applied up along each side of the limb, and fixed by two or three transverse or circular strips of plaster, it will be found that strong extension may be made by pulling on the two ends of the bandage, and may be rendered permanent by tying them to the lower part of the outside splint. During the early stages of the treatment, while the muscles are apt to contract spasmodically, it is well to insert in some way a piece of elastic material, which will yield somewhat, resuming its tension the moment the spasm subsides.

Some surgeons, among whom is Dr. Buck, of New York, discard the long splint for fractures of the thigh, making counter-extension from the head of the bed, and extension by a weight attached to the foot and hanging at the foot of the bed. From 15

to 30 pounds will be requisite for a man of average muscular development.

Short splints should always be employed when the long splints are omitted. They may be confined in place by means of circular bands of adhesive plaster, or by the upper turns of a roller which begins at the toes. If the long splints of Physick are used, they should be just wide enough to prevent the circular strips of bandage from bearing upon the skin of the limb; they should each be lined, if possible, with a piece of old blanket, folded in four or five thicknesses. When this cannot be had, cotton, linen, or tow may be substituted for it, or bran bags may be used. A splint-cloth is useless, the same purpose being much better served by giving each of the circular strips of bandage a turn around each splint, inclosing also the lining, which is thus kept in place. Some sort of old stuff, woolen if possible, should be folded so as to form a protection to the whole under surface of the limb. The circular strips of bandage will be sure to stretch somewhat during the first 24 or 48 hours; after that they may be made more secure by tacking them to the edges of the splints.

Various forms of inclined planes have been described for the treatment of fracture of the thigh. The single inclined plane may be very usefully employed, with careful watching by the surgeon; it is made by fastening a board, as long as from the tuber ischii to an inch or two beyond the heel, and inclined

at such an angle as may be judged suitable to an upright board, so that the latter shall project about a foot above the upper end of the former. Holes are bored in this projecting part, through which the extending bands pass to be tied, and the injured limb lies upon the slope, the weight of the body making the counter-extension.

The double inclined plane is well known; its most recent and approved form is that given to it by Dr. N. R. Smith, of Baltimore.

Dr. Smith's splint consists in a rectangular frame of stout iron wire, about 3 inches wide at one end, and 2½ or 2¾ at the other; it is intended to reach from a little above the spine of the ilium to a point just beyond the toes, and should, therefore, be about 3 feet 8 inches long for a man of ordinary stature. Cross-pieces of wire are firmly clinched to the side-pieces at intervals of about 8 inches. There are also two double hooks of wire, each of which is adapted to clip the side-wires firmly, and has a loop above like a figure of 8, forming an eye for the attachment of a suspending cord. A small pulley and a tent-block are useful, but not indispensable to the apparatus. When the splint is to be applied, it is bent so as to correspond with the front of the limb when the hip, knee, and ankle are somewhat flexed; it is then wrapped in the turns of a bandage, and the limb bound to its under surface. The double hooks are now made to catch the splint at about the middle of

the thigh and leg, and a cord attached to both; to the middle of this cord is tied the end of another, rove through the tent-block and passing over the pulley, which is fastened to the ceiling. Extension is made in proportion to the degree of slant assumed by this latter cord when the limb is thus suspended; the weight of the body is the counter-extending force. If the extension is not made properly, or if the splint presses too much or too little above or below, the points of attachment of the suspending cord should be changed; and the efficiency of the apparatus may be enhanced by raising the foot of the bed with blocks.

Sometimes, when the bone is broken obliquely and high up, it may be necessary to use the inclined plane in order to bring the lower fragment into proper relation with the upper, tilted upward by the action of the psoas and iliacus muscles.

At a late stage in the treatment, union having duly taken place, and the callus merely needing support, some form of the immovable apparatus may be found useful.

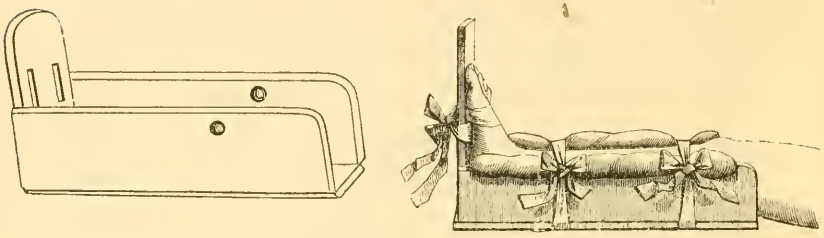
Fractures of the patella occur very rarely in army practice. When longitudinal, the only treatment they need is confinement of the limb and the subduing of inflammation. When transverse or oblique, it is necessary to fix the fragments, which may be done with strips of adhesive plaster applied above and be-

low, a splint being placed behind the knee to prevent anything like flexion. Another plan, described by Dr. Sanborn, is to apply a roller from the toes to the trunk; before covering the knee with this bandage, a strip of adhesive plaster is laid lengthwise down the front of the lower part of the thigh and upper part of the leg, and fastened by turns of the bandage or by other strips, its middle part being, however, left uncovered. A hard compress is now placed under this loop of adhesive plaster, above the upper fragment, and by pinching up the loop and twisting it with a piece of stick, the fragments will be pushed together.

Fractures of the bones of the leg are extremely troublesome when they occur on the march. The same means may be used in these cases as when the thigh is the seat of injury,—straw-splints, temporary extension, a fracture-box, as circumstances may allow. Support should be given to the whole limb, from heel to hip, and the foot should be carefully secured from falling either inward or outward.

The ordinary fracture-box, having a bottom, two sides, (fastened to the bottom by hinges of leather or iron, if possible,) and an end, the latter projecting up high enough to keep the bedclothes from weighing on the toes, may be stuffed with straw, or a pillow laid lengthwise in it, and serves as well or better than any other arrangement for the transportation of the

patient. (See cut.) Extension and counter-extension can be readily made in such a box, in a manner which will suggest itself, when shortening is present; adhesive plaster is the best material for the purpose.



Wire splints may be adapted to the leg, as to the thigh; and any form of apparatus that is used will be made more tolerable by the suspension of the entire limb. It is better in these cases, in fitting the wire splint, to make the angle at the knee more obtuse than for a fracture of the thigh, and always to hang the limb in such a way that the broken bones may be horizontal.

Should lateral angular deformity occur after fracture of the leg, it must be corrected by a careful adaptation of Dupuytren's plan, by binding the limb to a lateral splint, with a wedge-shaped compress arranged so as to bear against the projecting angle.

When, at an advanced stage of the treatment of fractures of the leg, pasteboard splints are used, they should always be applied to the sides of the limb; never to its posterior surface.

Fractures of the tarsal and metatarsal bones, as seen in military practice, are very apt not only to be compound, but to require amputation. In favorable cases, inflammation being subdued, a pasteboard splint should be accurately fitted to the front of the leg and back of the foot. When a fracture-box, like that recommended for the leg, can be had, it will insure greater comfort to the patient, especially if he has to be moved any distance.

AMPUTATIONS.

AMPUTATIONS.

The following general rules in regard to amputations, for the guidance of army surgeons in the field, are advocated by the best modern authorities on the subject.

NECESSITY OF AMPUTATION.

1. Cases where a limb is nearly or completely carried away, leaving a ragged stump, with laceration of the soft parts, and projection of the bone.

2. Cases in which the soft parts of a limb are extensively lacerated or contused, the principal arterial and nervous trunks destroyed, and the bone denuded or fractured.

3. Cases in which a similar condition exists, without either fracture or denudation of the bone.

4. Cases of compound and comminuted fracture, particularly those involving joints.

5. Gunshot wounds in which the ball does not actually penetrate the joint, but in which the bone being struck above or below, the fracture extends into the joint.

6. Gunshot wounds between the phalanges of the fingers or toes do not necessitate amputation.

7. Gunshot wounds penetrating the wrist, unless great laceration has occurred, do not necessarily demand amputation.

8. In gunshot injuries of the shoulder and elbow joints, provided the main blood-vessels and nerves are not injured, excision may be practiced with a fair prospect of success.

9. Compound fractures of the middle and lower part of the thigh, occasioned by gunshot, require amputation. As regards similar injuries in the upper two-thirds of the thigh, the mortality following amputations has been so very great that army surgeons have generally abandoned the operation.

Dr. Macleod, after a careful inquiry into this point, says :—

"Under circumstances of war, similar to those which occurred in the East, we ought to try to save compound comminuted fractures of the thigh, when situated in the upper third; but immediate amputation should be had recourse to in the case of a like accident occurring in the middle and lower third."

Such cases must be left to the judgment of the surgeon.

10. Gunshot wounds of the knee-joint demand amputation. The operation of excision, in the very few cases in which it has been practiced by army surgeons, has not been attended by favorable results. This want of success is not, however, to condemn,

except upon the field of battle, an operation which has been so successfully performed in cases of disease.

11. Gunshot fractures in the middle of the leg do not necessitate amputation, unless the arteries are destroyed, or the injuries involve the neighboring joints.

12. Gunshot injuries of the ankle do not necessarily require amputation. If the posterior tibial artery and nerve have escaped injury, and if the bones be not too extensively comminuted, attempts may be made to save the limb.

13. Great care should be exercised, before proceeding to amputation, to ascertain whether a patient may not be otherwise mortally wounded.

THE TIME FOR OPERATING.

In army practice, on the field, amputation, when necessary, ought to be primary. Patients, in most cases, cannot bear removal from the field without increased danger, neither can they have afterward the hygienic attentions which secondary amputations must necessarily require. Therefore:—

1. Amputate with as little delay as possible, after the receipt of the injury, in those cases where there is intense suffering from the presence in the wound of spicula of bone, or other foreign bodies, which the fingers or forceps cannot reach.

2. In those cases where a limb is nearly torn off,

and a dangerous hemorrhage is occurring, which cannot be arrested.

3. In those cases where it is *clearly* seen that the patient is not suffering from immediate collapse, or great nervous depression, a condition which will probably come on if there is any considerable delay. If the shock or collapse is extreme, the operation must be postponed, until, by appropriate measures, reaction is sufficiently established.

4. In certain cases, where the collapse is not extreme, the use of sulphuric ether, as an anæsthetic agent, often has the effect of bringing about a moderate reaction. Such cases would formerly have required delay.

5. In army practice, attempts to save a limb which might be perfectly successful in civil life, cannot be made. Especially is this the case in compound gunshot fractures of the thigh, bullet wounds of the knee-joint, and similar injuries of the leg, in which, at first sight, amputation may not seem necessary. Under such circumstances, attempts to preserve a limb will be followed by extreme local and constitutional disturbance. Conservative surgery is here an error; in order to save life, the limb must be sacrificed. Moreover, the suppuration and sloughing, attendant upon mutilated limbs, soon render the atmosphere of overcrowded hospitals or barracks perfectly unendurable; a fact entitled to a certain amount of weight, in cases where the propriety of primary amputation is at all questioned.

THE POINT OF SELECTION.

Modern surgery has abundantly shown that, as a general rule, the risk is greater in proportion as the size of the part which is amputated increases, and as the line of amputation approaches the trunk; in fact, the nearer to the trunk, the greater the danger. Therefore:—

1. As a general rule, other things being equal, save as much of the limb as possible.

2. When time is of consequence, disarticulation of a phalanx is sometimes preferable to the division of the bone in its continuity. Disarticulation of the toes is always preferable, except, in some cases, the first phalanx of the great toe may be divided through its middle portion.

3. However extensive may be an injury to the hand, endeavors should be made to save a portion of it, if it be only one or two fingers. Especially should an attempt be made to preserve the thumb, and even in the very worst looking cases, such is the great reparative power of nature in these parts, that the surgeon may generally accomplish much in this respect.

4. Where time is of consequence, and even in most cases, disarticulation at the wrist-joint is preferable to an attempt to save a few of the carpal bones.

5. In gunshot injuries of the foot, attempts may be made to save a portion of the member by either of the methods recommended by Hey, Chopart, Pirogoff,

or Syme. In place of Hey's operation, the disarticulation of the metatarsal bones from the tarsus being often troublesome, it is better to saw through the metatarsus just in front of the tarsal articulations. Should disarticulation at the ankle-joint be practiced, the removal of the malleoli must not be forgotten.

6. Other things being equal, it is best to save as much of the leg as possible, not exceeding three-fourths, in order for the better adaptation of an artificial limb.

7. In the rare cases which admit of its adoption, excision of the head of the femur is to be performed in preference to disarticulation, as being the least likely to lead to a fatal issue. When it is determined to perform amputation, it should, if possible, be made through the trochanters of the femur, rather than at the hip-joint.

8. In selecting the point for amputation, it must be remembered that, in gunshot wounds, the injuries are often far more extensive than they at first sight appear. Care therefore should be taken that the anxiety to preserve as much of the limb as possible does not influence the surgeon's better judgment to the detriment, and perhaps even to the loss, of his patient, from subsequent sloughing and gangrene.

HINTS FOR AFTER-TREATMENT.

1. When a wound is extensive, as in cases of amputation, it is far preferable to leave it open, with a

piece of wet lint, or a thin compress, interposed between the lips, for two or three hours, until the surface has become glazed. In this way, as reaction comes on, hemorrhage may be often avoided, or if it does occur, is easily controlled without the disturbance of the dressings.

There need be no fear as regards the number of the ligatures applied. It is better to employ too many than too few, at the time of operation.

2. The dressings of a stump should be as simple and as little cumbersome as the case will in any way admit of. A narrow strip of water-dressing should be laid along the edge of the incision, over the strips of adhesive plaster, and the part should be so arranged that one end of the incision may be more dependent, in order to facilitate the escape of all discharges. An outlet for this purpose should never be neglected.

3. The position of the stump is of the utmost importance. By proper attention to this point, the edges and surfaces of the incision may be brought into contact, and the patient is spared the pain and uneasiness which, under other circumstances, the tension and pressure necessary to bring the parts together must invariably produce.

4. If the dressings are properly applied, as a general rule these need not be changed for several days after amputation. Much mischief is undoubtedly done by a too hasty removal of the first dressings.

5. After removal of the first dressings, if union has not taken place by adhesive inflammation, and suppuration has commenced, with much heat and tenderness about the part, a poultice may be advantageously substituted for the water-dressing.

6. In all cases where there is much suppuration, and tendency to bagging of matter, the parts must be well supported by bandages.

7. Although complete primary union is desirable, the surgeon should not be over-anxious to bring about this result.

8. Of course, in cases where, after amputation, transportation of the patient to any considerable distance is contemplated, or likely to occur, the dressings must be so arranged that any such removal will not disturb the parts, and thus interfere with the safety or speedy recovery of the individual.

Amputations through the Foot and at the Ankle-Joint.

It is proposed in this paper to consider briefly those operations in the region of the foot which are generally regarded as conservative. They are all undertaken with a view either to preserve the largest extent of the extremity possible for subsequent unaided service, or to adapt a stump that affords the best medium for mechanical appliances.

PRESERVATION OF INDIVIDUAL TOES.

It is always desirable to preserve as many of the phalanges as possible. If the injury is of such a nature as to require the sacrifice of all but one toe, this should be preserved. The support which is given to the foot in the mechanism of progression, by even the small toe alone, is sufficient to warrant its preservation. Especially is it important to save the great toe, which forms so considerable a part of the foot.

AMPUTATION OF THE METATARSO-PHALANGEAL ARTICULATION.

When the injury requires the sacrifice of all the toes, the surgeon should, if the soft parts permit, remove them at their articulation with the metacarpal bones. The resulting extremity will be extremely serviceable without artificial aid.

Operation. — 1st. The operator, grasping all the toes in his left hand, makes, with a narrow knife, a semicircular incision, extending (for the left foot, and *vice versa*) from the internal border of the first metatarsal bone to the external border of the fifth, in front of the articulation of the toes with the metatarsus. 2d. The articulations are opened in succession with the point of the knife, and their ligaments divided. 3d. The knife is then carried behind the

phalanges for the purpose of cutting out a semicircular flap from the plantar surface of the foot.—*Lisfranc's Method in Bernard and Huette.*

EXCISION OF INDIVIDUAL METACARPAL BONES.

It occasionally happens that the local injury is of such a nature that by careful dissection the individual metacarpal bones may be removed, and the remainder of the foot be preserved. This is always preferable to any more considerable mutilation of the foot, and should not on any account be overlooked.

AMPUTATION AT THE TARSO-METATARSAL ARTICULATION.

If the injury involves so much of the extremity of the foot as to raise the question of amputation at a point higher than those already indicated, the surgeon should make every exertion to save the tarsus entire. If the soft parts allow it, this can be accomplished by amputation at the tarso-metatarsal articulation. The following description of the operation is condensed from Bernard and Huette:—

To recognize the Articulation.—1st. On the inner side of the foot carry the finger backward along the inner border of the metatarsal bone until a projection is encountered, one or two lines beyond; this is the articulation, situated in a depression between the two projections. The articulation may also be found just one inch anterior to the prominence of the scaphoid

bone. 2d. On the outer side follow the external border of the fifth metatarsal bone, until the prominence at its proximal extremity is recognized; the articulation lies immediately behind it; in some instances, the head of the metatarsal bone projects a trifle beyond the articulation.

Modes of Operating.—1st. The patient is placed upon his back, and the foot rotated moderately inward. The surgeon recognizes the exact situation of the articulation by the rules already laid down, and then grasps, with the palm of his left hand, the sole of the foot, his thumb being placed on the outer side of the proximal end of the fifth metatarsal bone, and the index finger at the internal extremity of the articulation. He then makes a semilunar incision with its convexity looking downward, from without inward, across the dorsum of the foot, passing about half an inch below the articulation, and extending from one of its extremities to the other down to the bones.

2d. The surgeon divides, with the point of his knife, the dorsal ligaments, carrying it along the line of the articulation from without inward, as already indicated, and recollecting that the articulation of the second metatarsal lies a third of an inch posterior to the others.

3d. The mortise in which the head of the second metatarsal is inclosed remains to be opened. This is effected by introducing the point of the knife be-

tween the internal cuneiform and the head of the first metatarsal bone, its edge being turned upward, and making an angle of 45° with the axis of the foot. The knife is then carried up to a right angle, its point traversing the whole of the inner surface of the mortise, in order to insure the division of the interosseous ligament; it is then withdrawn, and applied to the external surface of the mortise.

4th. When this has been accomplished, pressure is made upon the metatarsus to separate the articular surfaces, and their remaining ligamentous attachments are successively divided, especially those on the plantar aspect of the articulation, so that the knife may be carried readily beneath the heads of the metatarsal bones, and the operation is then finished by cutting out a flap from the sole of the foot, which should be somewhat larger at its internal than at its external part.*

AMPUTATION AT THE MEDIO-TARSAL ARTICULATION. (CHOPART'S OPERATION.)

To recognize the Articulation. (*Condensed from Bernard and Huette.*)—The articulation at the middle of the tarsus is formed by the astragalus and the os calcis behind, and by the cuboid and scaphoid in

* The operation above described is generally known in this country as *Lisfranc's operation* on the foot, and it is distinguished by this title from *Hey's operation* through the metatarsus.

front; the interarticular line which crosses the foot transversely resembles the italic ∞ of which the anterior convexity is internal and its posterior convexity external. The internal extremity of the articulation is just one inch in front of the internal malleolus, and two lines and a half behind the tuberosity of the scaphoid. The external extremity is half an inch behind the projection formed by the head of the fifth metatarsal bone. It corresponds with a prominence on the external surface of the cuboid bone, which is situated just one inch in front of the external malleolus. The center of the articulation lies immediately in front of the head of the astragalus, which can be made to project by forcibly extending the foot. On the outside of this prominence is a depression sensible to the touch, lying between the astragalus, the cuboid, and the os calcis; the articulation is immediately in front of this.

Rules in Operating.—1st. The exact position of the articulation having been recognized by the means above indicated, the surgeon grasps the foot with his left hand, its sole being placed in his palm, his thumb upon the external extremity of the articulation, and the index finger upon the tuberosity of the scaphoid bone. 2d. The knife is then to be carried across the dorsum of the foot from the thumb toward the index finger, making a semicircular incision which descends about half an inch below the line of the articulation. 3d. After the retraction of the integuments, divide

the tendons which remain uncut and open the articulation, bearing in mind the varying obliquity of the articular surfaces as already indicated, and also to divide thoroughly the fibrous bands connecting the scaphoid and astragalus before attempting to enter the joint, as the thin edge of the scaphoid juts over the latter in some degree. 4th. The articulation being entirely laid open, and all its ligaments freely divided, pass the flat of the blade behind the bones, and having brought up the end of the foot into its natural position, cut out a flap from its plantar surface, which should extend beyond the sesamoid bones in order to possess sufficient length; the knife should graze the bones in making the flap, care being taken to avoid the projections of the scaphoid, cuboid, and first and fifth metatarsals.

AMPUTATION AT THE ANKLE-JOINT.

Amputation at the ankle-joint was performed with very indifferent success by the older surgeons. The failure was due rather to the inutility of the stump than to the mortality after the operation. It was their invariable practice to make the flaps from the tissues about the ankle, and, with but rare exceptions, they left the malleoli undisturbed. The first difficulty which they experienced was in closing the wound over the projecting malleoli, and the second was the protrusion of these processes through the meager covering of the stump when the patient be-

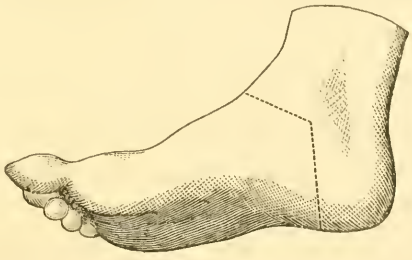
gan to use his limb. Unfavorable as were the circumstances attending the early methods of performing this operation, still many cases are on record in which a useful limb was obtained, due, doubtless, to the entire or partial absorption of the malleoli. Amputation at the ankle-joint did not, therefore, obtain a place among the legitimate operations of the earlier surgeons. It may fairly be questioned if operative surgery has in any instance made a more important advance toward the realization of its humane purposes of saving life and restoring useless limbs than in this single particular of amputation at the ankle-joint. Previously to 1843, in all affections of the foot involving its removal, amputation was performed through the leg. The mortality after this operation, always considerable, varies with circumstances. In the Parisian hospitals it has been estimated as high as fifty per cent., even when performed for chronic disease, a condition most favorable to success. American hospitals give thirty-seven per cent., and English hospitals nearly twenty per cent. A fair average of the mortality of this operation may be put at twenty-five per cent. In 1850, Mr. Syme stated (*Monthly Journal*) that he had performed amputation at the ankle between thirty and forty times, with the loss of but a single patient, and in this case the unfortunate result was not due to the operation. More recently he remarks: "The operation itself I believe to be as free from risk as the removal of a finger or toe."

There are now two principal methods of amputation at the ankle-joint, known respectively by their projectors as Syme's and Pirogoff's operations. The relative merits of these operations will be more easily appreciated by describing the methods pursued and grouping the facts which experience has thus far accumulated.

SYME'S METHOD.

Operation.—The foot being placed at a right angle to the leg, a line drawn from the center of one malleolus to that of the other, directly across the sole of the foot, will show the proper extent of the posterior flap. The knife should be entered close up to the fibular malleolus, and carried to a point on the same level of the opposite side, which will be a little below the tibial malleolus. The anterior incision should join the two points just mentioned at an angle of 45° to the sole of the foot and along the axis of the leg. In dissecting the posterior flap, the operator should place the fingers of his left hand upon the heel, while the thumb rests upon the edge of the integuments, and then cut between the nail of the thumb and tuberosity of the os calcis, so as to avoid lacerating the soft parts, which he, at the same time, gently but steadily presses back until he exposes and divides the tendo-Achillis. The foot should be disarticulated before the malleolar projections are removed, which it is always proper to do, and which may be most easily

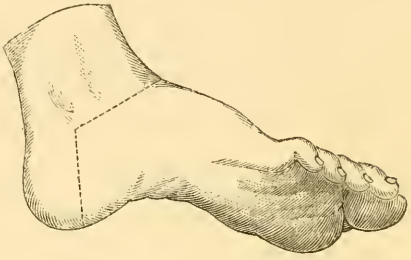
effected by passing a knife around the exposed extremities of the bones, and then sawing off a thin slice of the tibia connecting the two processes.* Mr. Syme directs the articular surface of the tibia always to be removed. This certainly should be done, if the disease has attacked the part; but if healthy it seems to be unnecessary. In one of the writer's cases the extremity of the tibia was removed, but without any apparent benefit as respects the result. The following wood-cuts, of reduced size, taken from similar illustrations in the *Monthly Journal*, Feb. 1850, give a more correct idea of the line of incision than can any verbal description. It will be seen that they



differ very materially from those given in text-books. The principal precaution to be observed, is in the dissection on the posterior part of the os calcis, in order not to wound the posterior tibial artery, and thus deprive the flap of its nourishment. It is recommended by some surgeons to disarticulate before dissecting the posterior flap. This proceeding increases

* Syme's Contributions to Surgery.

the liability to wound this vessel, nor does it facilitate the operation. The artery may readily be avoided by keeping the edge of the knife constantly



turned from the flap toward the bone. By this means also the operator will not be liable to puncture the posterior flap, an accident which has occasionally occurred, but which does no harm.

PIROGOFF'S METHOD.

Operation.—The following description of this method is taken from a London medical journal, and was translated from the author:—

"I commence my incision close in front of the outer malleolus, carry it vertically downward to the sole of the foot, then transversely across the sole, and lastly obliquely upward to the inner malleolus, where I terminate it a couple of lines anterior to the malleolus. Thus all the soft parts are divided at once quite down to the os calcis. I now connect the outer and inner extremity of this first incision by a second semilunar incision, the convexity of which looks forward, carried a few lines anterior to the tibio-tarsal articulation. I cut through all the soft parts at once down to the bones, and then proceed to open the joint from the front, cutting through the lateral ligaments, and thus exarticulate the

head of the astragalus. I now place a small, narrow amputation saw obliquely upon the os calcis behind the astragalus, exactly upon the sustentaculum tali, and saw through the os calcis, so that the saw passes into the first incision through the soft parts. Saw carefully, or the anterior surface of the tendo-Achillis, which is only covered by a layer of fat and a thin fibrous sheath, might be injured. I separate the short anterior flap from the two malleoli, and saw through them at the same time close to their base. I turn this flap forward, and bring the cut surface of the os calcis in apposition with the articular surface of the tibia. If the latter be diseased, it is sometimes necessary also to saw off from it a thin slice with the malleoli."

Pirogoff believes also that the tendons should not be cut off too short; in other words—

"Not too near the spot where their synovial sheaths are cut through: their ends should rather project a little. If they are cut too short, they conceal themselves in the fibrous canal, or, what is worse, when the limb is moved, they slip upward out of their sheaths."

He adds:—

"I fear nothing so much as this, namely, when the belly of the muscle contracts, and draws up the tendon divided, or half destroyed by suppuration, out of the sheath. I am convinced that the fixing of the tendons before and during the operation by methodical pressure, and the continuous maintenance of the limb in one and the same position by the plaster of Paris bandage, may contribute a great deal toward the successful result of these operations."

The following description of the several steps of the operation, as more recently performed, is given by Mr. Croft, (London *Lancet*, Feb. 6, 1858,) one of

the surgeons of the Dreadnought Hospital, where the operation had, at that date, been performed six times. He says:—

"The mode of operation, as performed by Mr. Busk, Mr. Tudor, and myself, is to grasp the projecting portion of the foot with the left hand, then to enter the point of the knife *immediately* behind the malleolus, and make a semicircular incision in front of the point, terminating at a corresponding point behind the opposite malleolus; next, to carry the incision downward and slightly forward to the edge of the sole of the foot, straight across the sole, and terminate it at the opposite malleolus, or the point at which the incision was commenced. Having disarticulated the foot, the soft parts are to be separated from around the os calcis in a line from the posterior margin of the upper articulating surface to the under edge of the articulating surface of the cuboid, and the mass in front of this line to be removed by the saw. The ends of the tibia and fibula are sawn off in the way usual in Syme's operation. During the process of separating the soft, or rather tough parts about the os calcis, care should be taken to keep the edge of the knife close to the bone, in order to avoid wounding the posterior tibial or plantar arteries. The portion of the os calcis left on the flap should be placed in contact with the end of the tibia, and if the saw has been entered well behind the calcaneo-astragaloid articulation, and brought out at the under margin of the calcaneo-cuboid articulation, the contact will be accurate. If the bones cannot be placed in accurate contact, thin slices of bone from the upper and back part of the portion of the os calcis should be removed by the saw until they can be adapted. The saw we prefer is Bigg and Milliken's modification of Butcher's Dublin saw."

REMARKS.

In deciding upon the point of amputation, surgeons are very properly governed by the following simple rules:—

1st. The comparative danger of the operation; and

2d. The comparative usefulness of the stump.

If there were two given points at which an amputation might be performed, no prudent surgeon would select the one having the largest mortality, unless the ultimate advantages were of the utmost importance to the usefulness or happiness of the patient. Of the operations on the foot which we have passed in review, it may be said that in all which involve the parts anterior to the medio-tarsal, or Chopart's amputation, these two conditions combine to determine the surgeon to save as much of the extremity as possible. The mortality of the operation diminishes and the usefulness of the limb increases in proportion to the amount preserved. There can be no doubt, therefore, that it is the duty of the operator to preserve as much of the anterior portion of the foot as possible.

But new and important questions arise when we attempt to decide upon the value of the three remaining operations by the rules proposed. With a view to a proper appreciation of the alleged advantages and disadvantages of these amputations, in order to arrive at correct conclusions as to their comparative

merits, we present the following summary of opinions by surgical authorities.

Chopart's Operation.—Chopart's operation has now been practiced nearly three-quarters of a century, and has been, during the whole period, the subject of severe criticism. On the one hand, it is contended that the stump is entirely serviceable, that the operation is attended with slight mortality, and that by it an important portion of the foot is preserved. On the other, it is asserted that the stump is generally tender, very often affected with incurable ulcers, and, finally, that the extremity of the stump is liable to become the most depending portion, and the cicatrix the point of support. Some attribute this tendency to retraction of the heel to the action of the feebly antagonized extensors of the foot, and others to the removal of one-half of the arch of the foot. Whatever may be the explanation, it is certain that surgeons have constantly met with this position of the stump, and endeavor to remedy it. Within three years of its introduction, Pétit divided the tendo-Achillis to relieve the defect, and this operation has often been repeated since.

Reports unfavorable to the operation have frequently been made by surgical authorities. In 1815 Villermé reported a score of cases in which the patients could walk well only from five months to two years after the operation. Bouvier recently read a paper before the Society of Surgery, Paris, in which

he condemned Chopart's operation in strong terms. According to him, bad results almost invariably follow in time; these patients fill the hospitals of incurables; section of the tendon is only a temporary expedient, and the difficulty returns on its reunion; he therefore advised its rejection.

In reply to this communication, Chassaignac declared the amputation of Chopart to be an excellent operation, and referred to cases in which the patients walked well without division of the tendon, to others where the division of the tendon relieved the difficulty, and finally to some who walked freely upon the face of the stump itself. He thought the operation should not be rejected, but be perfected, since it was very safe; the division of the tendo-Achillis is now very frequently practiced, either immediately after the operation, or when the heel has been elevated and the cicatrix has become the most depending portion.

The opinions of the following well-known authorities may be added: Blandin asserts that he has met with retraction of the stump but once in eleven amputations. Velpeau did not meet with retraction in five cases, and regards it as an exceptional occurrence. Nélaton approves the operation, and thinks retraction may or may not take place; if it occur, division of the tendo-Achillis relieves it for a time at least. Mr. Fergusson and Mr. Cock, of London, have remedied this condition by division of the tendo-

Achillis, and do not consider it a valid objection. Mr. Syme, on the contrary, seems to reject Chopart's operation altogether. In some clinical remarks on a case upon which he was about to perform his operation, in 1852, he said:—

"There is extensive disease of the tarsus, not leaving room for the performance of Chopart's operation, even if I deemed it expedient, which I have long ceased to do, from conviction of its inferiority to that at the ankle, especially in regard to the protection afforded against relapse. In one year alone I performed three secondary amputations at the ankle to remedy the sequelæ of Chopart's operation."

Prof. Gross expresses himself strongly in favor of the operation. He says:—

"Of the utility of this procedure, in the class of cases under consideration, there can no longer be any doubt; I have employed it several times in my own practice, and I have seen it repeatedly executed by others, and in every instance that has come within my notice, the result has been most satisfactory."

Syme's Operation.—Syme's method is now an accepted operation with the surgeons of Great Britain. Mr. Fergusson, who had operated eight times, says:—

"In so far as I can judge, it is one of the greatest improvements in modern surgery as regards the subject of amputation."

Mr. Erichsen remarks that it

"Constitutes one of the greatest improvements of recent date in operative surgery, as by its performance amputation of the leg may often be avoided, and the patient being left with an exceed-

ingly useful stump, the covering of which being ingeniously taken from the heel, constitutes an excellent basis of support."

Mr. Quain thinks the operation

"Free from any valid objection, and, what is more important, the result in practice has been found to be good. A person who has undergone this operation is enabled to bear his whole weight upon the end of the stump without inconvenience; and, on this account, the facility of progression is, with a proper apparatus, decidedly greater than when the amputation is performed at any higher part of the limb."

On the contrary, it is alleged against this operation—

1st. That it is *difficult and tedious.* But Mr. Syme states that he requires less time than a minute to perform it.

2d. That the *flap is liable to slough.* This, however, rarely takes place to any considerable extent. Mr. Syme says:—

"That the flap may, and probably will still occasionally slough, is unhappily too true; but that this result is always owing to an error in the mode of performance, I think does not admit of any question. For as the integument, being detached from its subjacent connections, can derive nourishment only from the anastomosing vessels, it is evident that if scored crossways, instead of being separated by cutting parallel to the surface, the flap must lose its vitality."

3d. *That there is a necessary delay in the healing of the wound.* From recent statistics it appears that union is much more prompt, in a given number of

cases, in Syme's than in Chopart's amputation. Dr. Van Buren, of New York, has met with union by the first intention; in a case which recently came under the writer's observation, the patient bore her weight on the stump on the fifteenth day, union being at that date complete.

4th. *That the stump is sensitive, and hence not serviceable.* Mr. Syme remarks:—

"Patients who had suffered the operation, were able to stand, walk, and even run, without any covering or protection of the stump; and a gentleman present, having had his attention accidentally directed, a few days before, to some boys who were amusing themselves on a slide in the street, discovered that one of them had undergone amputation at the ankle-joint."

Dr. Van Buren, of New York, states that a patient recently presented himself at the college clinic of the University Medical College, on whom Mr. Syme performed his operation sixteen years ago, being the third person on whom the operation was performed, who stated that he had walked thirty miles in a day without inconvenience from his stump. We may add the following fact, which came under our own observation: A man presented himself at Bellevue Hospital during the last winter, who had undergone amputation at the ankle-joint, by Dr. Carnochan, a year or more previously. He was a book-peddler by occupation, and stated that he not unfrequently walked eight miles daily, without fatigue or inconvenience from his mutilated limb. He had but a

very slight limp. He wore a short shoe, with the sole raised sufficiently to compensate for the loss of the foot. We may add that recent statistics show that but a single case is authenticated of a stump so sensitive as not to admit the weight of the body.

Pirogoff's Operation.—Pirogoff claims for his method of amputation the following advantages: 1. The tendo-Achillis is not divided, and we avoid all the disadvantages connected with its injury. 2. It also follows that the base of the posterior flap is not thinner than its apex, while the skin on the base of the flap remains ununited with the fibrous sheath of the tendo-Achillis. 3. The posterior flap is not cap-like, as in Syme's method, and its form is therefore less favorable to a collection of pus. 4. The leg after this operation appears an inch and a half (sometimes even more) longer than in the three other operations, (Syme, Baudens, Roux,) because the remnant of the os calcis left in the flap, as it unites with the inferior extremities of the tibia and fibula, lengthens them by an inch and a half. 5. Serves the patient as the point of support.

Mr. Croft furnishes the following account of the six cases occurring at the Dreadnought:—

"Six times the operation has been performed, and in four instances with most perfect success; but in the two remaining, death removed the subjects of operation before cure was completed—in the first instance by granular disease of the kidneys, and in the second instance by secondary deposits of pus in vari-

ous joints. In two of the six cases in which cure was completed, the operation was performed for the removal of scrofulous disease of the articulation between the tarsal bones; and in the two others the operation was for frost-bite of the anterior part of the foot. Progress toward health was marked by suppuration along the tendons of the tibialis anticus and posticus, and the peroneal tendons in each of the cases, but not by exfoliation of bone. The posterior part of the os calcis was united firmly with the tibia, generally in about three weeks; but in one instance—the last in which the operation was performed—union was good at the end of twelve days. I may here remark, that although the os calcis may be diseased at and about its articulation in instances of scrofulous disease of the joints of the tarsus, it is rarely that the posterior part is rendered too unhealthy to be made use of in the formation of a stump. The advantages of this operation over 'Syme's' (the only operation with which it can be compared) are, that it may be performed more rapidly as to time, leaves a more vascular flap, forms a longer stump, and produces a firmer pad for the subject to walk upon. Less time is occupied in the operation, for the somewhat troublesome dissection of the skin of the heel from the os calcis is avoided, and the os calcis sawn through instead. Greater vascularity of the flap is secured, for the plantar arteries are divided in the hollow of the foot. The length of the stump is a very important point; it is longer than in Syme's operation, by the portion of the os calcis left on the flap, which should be quite one inch and a quarter. In the four instances mentioned, the difference in length between the foot operated upon and the sound foot, was never more than three-eighths of an inch."

Mr. Busk, of the same hospital, who has operated three times, says:—

"Greater facility and rapidity of execution; less disturbance of the natural relations of the parts which are to form the cushion

of support; a solid instead of a hollow flap; and lastly, a greater length of stump, amounting to at least one inch and a half,—are such recommendations as few will be found to deny, and against which nothing, so far as I can perceive, is to be opposed."

In regard to the liability to non-union of the fragment of os calcis, we have the following testimony. Pirogoff says of his first three cases:—

"Notwithstanding the suppuration and considerable gravitation of pus into the flap in the third case; notwithstanding the softness and fatty degeneration of the os calcis, which could be cut with the knife, in the second case; and lastly, notwithstanding the bleeding fungous excrescences which formed on the bones, also in the second case,—still the remains of the os calcis united firmly with the tibia and fibula. Lastly, one of the cases, the third, proves that the exarticulation at the ankle-joint after my method—at least in children and young people—may be undertaken even in cases of diseased ankle-joint, provided disorganization has not extended too far over the soft parts about the articulation. In the boy in the second case, I found pus in the capsule during the operation, the cartilages softened and decayed, the ends of the bones also softened, and in a state of fatty degeneration, yet the result of the operation was most successful."

Mr. Busk says:—

"Some have feared that the section left of the calcaneum would not readily unite with the extremity of the tibia; but this fear is groundless. In the last operation performed by Mr. Tudor, union was found to be quite firm on the twelfth day. * * * In my first case, the man could support his whole weight on the stump within a fortnight."

A correspondent of a London medical journal thus records an interview with Mr. Syme:—

"Mr. Syme spoke of it (Pirogoff's operation) with much contempt, alleging that the retained extremity of the os calcis would, in the first place, be likely to act as a foreign body, and cause irritation, and that even if good union were obtained, the limb would be too long to be useful. * * * I can only say that some of the best stumps I have ever seen have been obtained by it, and that so far from the portion of os calcis acting as a foreign body, it usually unites easily and firmly to the tibia. In London the operation has been performed by Mr. Ure, of St. Mary's, by Mr. Simon, of St. Thomas, by Messrs. Busk, Tudor, and Croft at the Dreadnought, and by Mr. Fergusson and Mr. Partridge in King's College; all of whom have, I believe, been, on the whole, well satisfied with its results. At the Glasgow Royal Infirmary, Dr. McGhee, the Medical Superintendent, showed me a case in which it had been performed seven weeks previously. The stump was just healed, and promised to be an excellent one. It was, I understand, the first case in Glasgow in which that operation had been adopted."

The objections generally raised to this operation, are thus summed up by Mr. Syme, in comparing it with his own method. He alleges that—

"This operation deprives *his* of all its advantages in the first place, by rendering it complicated instead of extremely simple; secondly, by making the stump too long; thirdly, by impairing its constitution; fourthly, by retaining a portion of the osseous tissue justly liable to the suspicion of relapse; and fifthly, by not being applicable to all cases requiring amputation at the ankle."

The preceding opinions, quoted from surgeons who have had experience in this operation, practically refute these objections. They all regard Pirogoff's operation as the more simple; the greater length of

the limb is considered an advantage to the poor man who has no artificial limb; the stump is thought to be more sound and serviceable; the liability of the osseous portion of the flap to necrosis is denied; it is deemed applicable to all cases suitable for Syme's operation, provided only the posterior portion of the os calcis is not diseased.

Pirogoff's operation has now been performed upwards of twelve times by the surgeons of Great Britain; and all who have operated have spoken favorably of it.

GENERAL APPRECIATION OF THE AMPUTATIONS OF CHOPART, SYME, AND PIROGOFF.

Taking the foregoing facts as the basis of an appreciation of the comparative merits of these several operations, with such suggestions from experience as may occur to us, we are prepared to determine their relative value, and definitively apply the rules in operative surgery already stated.

1st. *The Operation decided by Comparative Mortality.*—Statistics do not determine with sufficient accuracy the comparative mortality of these several amputations. It does not appear that the influence of the diseases or accidents for which amputation was undertaken, upon the mortality, is estimated in these summaries. Chopart's operation has always been regarded as attended with very little danger. In Mr. Syme's extensive experience in his own operation,

the mortality is almost nominal. He states that he regards it as no more fatal than amputation of the finger; in forty cases, he had but one death, and that was not fairly attributable to the operation. From our own observations we should not regard Syme's operation as any more fatal than Chopart's, in the same individual cases. Nor can we believe, if we attach proper importance to the opinions of the eminent surgeons who have practiced Pirogoff's method, already brought forward, that, independently of the coexistent disease or injury, this operation is more dangerous than either of the two preceding amputations. All speak with great confidence of its safety. If to the foregoing facts we add the additional consideration, that the danger in all these operations is for the most part the same, viz., the liability to suppurative inflammation in the sheaths of the divided tendons, we can but believe that the actual mortality from the three operations is not widely different. We may conclude, therefore, that—

The comparative mortality of Chopart's, Syme's, and Pirogoff's amputations is too slight to influence the surgeon in his selection.

2d. *The individual operation should be determined by the Serviceableness of the Stump.*—This question involves, according to previous rules in determining the point of election in amputations, the social condition of the patient. The poor man's and the rich man's leg have long decided the point of amputation of the

lower extremity. This distinction is made in the belief that the poor man will either have no artificial appliance to his stump, or one of the rudest character, while the rich man will avail himself of the highest degree of art to compensate his loss. This question must always present itself to the military surgeon, if the rule remains valid, for in the ranks of every army we find, as in society at large, persons filling every grade of social position.

In our time, when mechanical surgery is doing so much to supply the maimed with serviceable limbs, and in this country, where public and private charity is so lavish in the relief of suffering, and the poorest may, by economy, accumulate wealth, the question may well be mooted if this old rule in operative surgery should longer govern the surgeon. Especially may we doubt its propriety, when the subject of the operation is under middle life. The instances are becoming more and more frequent where persons in humble circumstances, who have had a limb removed according to this rule, have subsequently been able to supply themselves with artificial aids, and have bitterly regretted that they have been deprived of the opportunity by the surgeon. It cannot be denied that in such cases the rule has operated to the serious disadvantage of the patient. We must conclude, therefore, that with American surgeons this rule should be modified thus:—

Under all circumstances, except where poverty and

advanced age, and confirmed dissolute habits, so combine in the individual as to render it certain that mechanical appliances would be of little service, give the patient the stump best adapted to the most useful artificial limb.

The two following questions grow out of this conclusion:—

1st. Of the three above-mentioned operations, which gives the most useful stump for progression without aid?

2d. Which affords the best stump for artificial appliances?

In regard to Chopart's amputation, it has been seen that the testimony of surgeons is very conflicting as to the usefulness of the stump. It cannot, we think, be denied that it has frequently required subsequent interference, such as division of the tendo-Achillis, a support under the anterior part of the stump, etc., in order to prevent such a degree of retraction of the heel as would bring the cicatrix to the most dependent part. Indeed, no one can examine the normal relations of the tarsal bones without being struck with the fact, that by this operation more than half of the anterior part of an arch is removed, leaving the remaining portion to sustain the entire weight which before belonged to the whole. It could scarcely result otherwise than that, in a well-formed foot, the posterior half of the arch would fall under the superincumbent weight. If we add to this, the constant elevation of the heel by the powerful and

feebly antagonized muscle of the calf, we can only be surprised that in time every stump of this kind is not turned with its face downward. And it must be admitted by the most ardent advocates of this operation, that in some instances it has been found impossible to remedy these defects, and patients have remained permanently unable to bear their weight upon the stump.

It has been alleged, as already noted, that in Syme's operation the stump is often so tender that the patient cannot bear his weight upon it. Such an opinion would seem to be rather theoretical than practical. We do not know of any well-founded proofs that such a result follows. On the contrary, Mr. Syme's testimony, as we have already stated, coincides with our own experience, that the stumps are capable of great endurance. Of Pirogoff's operation we cannot speak as confidently, from want of sufficient evidence; but it will be seen in the preceding pages, that so far as we have obtained the opinions of those who have had the most experience, the stumps, when firmly healed, are capable of sustaining any desirable degree of direct use. It must not be overlooked, however, that sinuses occasionally form, leading to carious bone, which long remain a serious drawback to the usefulness of the stump.

We are authorized in concluding:—

That the stump after Syme's or Pirogoff's operation

is the most serviceable, without artificial aid; preference being given to the former.

The question of adapting artificial limbs to these several stumps mainly rests with those engaged in mechanical surgery. So far as we have been able to ascertain the facts, Syme's operation gives much the best stump for an artificial extremity. Although a foot can be supplied cheaply in Chopart's amputation, yet it but poorly remedies the defect, and does not improve the patient's power of walking. An artificial limb may be applied to Syme's stump, which both relieves deformity and renders the patient's gait free from the slightest halt. The following opinion of an intelligent mechanical surgeon of great experience, is worthy of notice:—

"Among the numerous instances of mutilated feet through the tarsus, which fall to our care for treatment, it is seldom that we are able to designate a perfectly satisfactory stump, one to be preferred to what might have been made of parts contiguous. Nine-tenths of the mutilations, as by Chopart, present one or more of the following diagnostics, to wit: *First*, of an insufficient covering; caries, more or less, of the remaining tarsal bones; ulceration of the surrounding soft parts, or that of a thin shining pellicle of covering, exceedingly susceptible, quickly inflamed, and abraded by the least exposure, which renders it hazardous or difficult to attempt the application of any substitute. *Second*, a total inability to flex the stump, and to preserve its normal position at a right angle with the line of the leg; a morbid contraction of the gastrocnemii muscles, (without antagonism,) and retraction of the heel; a pendent position of the end of the stump, and exposure of the cicatrix to be pressed to the ground by the

weight of the body, with its general inutility for walking. No possible advantage can be obtained by an amputation of the foot which involves in the sacrifice the greater portion of the tarsus, but what will be largely enhanced by a well-timed operation at the *ankle-joint*, after the mode of Mr. Syme: therefore, by every consideration of humanity and art, I am led to regard that site as the one which should be designated as the SECOND PLACE OF ELECTION."

We are not aware that any artificial limb has yet been devised for the stump after Pirogoff's amputation. We may add, that those skilled in the manufacture of artificial limbs consider this stump very poorly adapted for a useful mechanical contrivance.

We conclude:—

That the stump after Syme's amputation is much better adapted for an artificial appliance than that resulting from either Chopart's or Pirogoff's operation.

After-treatment.—The subsequent treatment of operations of the foot is of great importance, as regards their ultimate success. Although immediate union is always desirable, yet it is not always attainable, even under the most favorable circumstances, as where operations are performed in the immediate vicinity of lacerated wounds, as must frequently occur in attempts to save fragments of the foot. Union by granulation cannot be anticipated. In view of the liability of the wounds left after amputations through the foot, and the excision of bones, to suppuration, and the consequent dangers of pyæmia, the practice of leaving them open to heal by granulations

is becoming more and more general. The process of cure proceeds more favorably in a given number of cases thus treated, than when the wound is at once closed; and the cicatrix which forms under these circumstances is both symmetrical and useful.

We deem it advisable also, in Syme's amputation, not to close the wound immediately. Owing to the constant oozing of blood in four cases performed in Bellevue Hospital, the stump was not dressed for several hours. The limb was placed in an elevated position, and cold water freely applied. The advantages of this delay were evident; the deep cavity formed by the extremity of the heel in the posterior flap contracted to a small size, which, with the complete cessation of the oozing of blood, removed the danger following its collection and disorganization in this situation. In every instance, when the wound was dressed, the posterior flap was found as warm as the leg, and quite as sensitive to the prick of the needle, showing that its vascular and nervous supply was undiminished. The only other fact worthy of notice in the after-treatment, was the daily injection of tepid water and disinfecting fluids into the cavity of the stump while suppuration continued. By these means the internal surface of the wound was cleansed and the process of granulation and adhesion promoted.

GENERAL CONCLUSIONS.

I. In all amputations of the lower extremity, the surgeon should be governed in the selection of the point of operation and the method to be adopted:—

1. By the mortality of the operations in question.
2. By the adaptability of the stump to the most serviceable artificial limbs.

II. In all injuries of the foot, involving parts anterior to the medio-tarsal articulation, the surgeon should sacrifice as little as possible of the structures essential to progression. He should preserve:—

1. Single phalanges, the importance of which increases from the small to the great toe.
2. The metatarsus, by amputation of the phalanges, or by the excision of individual metacarpal bones.
3. The tarsus, by amputation at the tarso-metatarsal articulation, (Hey's or Lisfranc's method.)

III. Of the amputations through the tarsus or at the ankle-joint, preference should be given to Syme's operation, as affording a minimum mortality, with a stump best adapted to an artificial limb.

IV. In the after-treatment of the amputations and resections above considered, it is good practice to leave the wounds open to heal by granulation.

THE EXCISION OF JOINTS

FOR TRAUMATIC CAUSE.

THE EXCISION OF JOINTS

FOR

TRAUMATIC CAUSE.

Although excisions have been practiced upon all the articulations of both extremities, for traumatic lesions which would otherwise demand amputation, satisfactory experience of their results, except in the shoulder and elbow, is at present either wanting or of a very limited character. To appreciate their exact value for each individual joint is, consequently, hardly practicable. More than this, the peculiarities of these operations, and the conditions which justify their adoption, are such that, in the varying fortunes of a campaign, the character of the injuries inflicted, the state of surgical resources, or other circumstances, may even require them to be abandoned altogether. The propriety of their performance, also, obviously varies with the limb implicated. An excision in the lower extremity, which is designed to support the weight of the body and is the chief agent in locomotion, is evidently a different thing from one in the upper extremity, which, with gentler movements to execute, has no weight to sustain, acts independently

of its fellow, permits exercise and locomotion during the processes of cure, and which may be shortened, deprived of certain uses, and limited in others, yet still remains of the greatest service. The contrast is made still more apparent when we remember the admirable substitutes for the lower extremity which mechanical ingenuity has furnished, while the most imperfect and partial movements of the hand surpass in usefulness those of the best artificial contrivances which have yet been invented.

The wounds made by round bullets, (rarely those by Minie balls,) by fragments of shell, and occasionally those from saber cuts, or from the smaller projectiles thrown by cannon, are almost the only injuries in which excisions can be attempted. Compound dislocations, sometimes happening from accidents in mounted drill, or possibly during an engagement, are thought by many authorities to demand removal of the projecting articulating surface, rather than simple reduction. The precise traumatic conditions to which these operations are adapted are not, however, easily determined. Gunshot injuries of joints, especially in the lower extremity, are apt, either unquestionably to demand amputation, or else to hold out some hope from expectant treatment; the choice left is not the easy one between excision and amputation, but the difficult and perplexing one between excision and an attempt to save a limb without an operation. A knee-joint completely shattered,

with extensively lacerated soft parts, excites no doubt in the surgeon's mind as to what course he shall pursue. The single small bullet wound, in the vicinity of an articulation, with no crepitus, a doubtful synovial discharge, and no local or constitutional symptoms, is a condition which cannot but embarrass the most experienced in deciding upon so grave an operation as that of excision. Yet this is precisely the character of injuries in which the question of conservative operations is to be decided. A ball imbedded in or near an articulation may at first give rise to little disturbance, but if left to itself, will sooner or later excite the well-known signs of joint injury, with long and wasting suppuration, deep and painful abscesses, and their concomitant dangers; and when these symptoms have manifested themselves, excision, or indeed any other operation, offers but little prospect of success.

It is clear, then, that the circumstances, if not the cases, which permit of excision, must be of comparatively rare occurrence. The tendency of modern practice has led us to hope much from conservative surgery, and the success of excisions for disease and for traumatic causes in civil hospitals has encouraged the expectation of results equally brilliant from the same practice after gunshot wounds received in battle. But the fact cannot be concealed, that excisions, hardly excepting even those of the head of the humerus and of the elbow, are operations not

likely to succeed in the hospitals of an army under any circumstances. The unfavorable hygienic conditions which must prevail among large numbers of wounded men congregated together will often decide the fate of the soldier whose limb a mistaken kindness may have tempted his surgeon into the endeavor to preserve. To incline toward the side of conservatism in cases permitting of doubt, will be to see patients die whose lives amputation might have saved. It was for these reasons that the practice of conservative surgery was so very limited in the recent Italian campaign, and in the lower extremity almost abandoned. They cannot but weigh with equal force in that in which the United States army is now engaged.

So much being premised, the most important points connected with the various excisions will now be passed rapidly in review.

HEAD OF THE HUMERUS.

The advanced position of the soldier's shoulder when in the act of firing makes it an event of not infrequent occurrence for a bullet either to bury itself in the head of the humerus, or to traverse it without much comminution, or, striking immediately below it, to break the bone short off at its neck. Heavier projectiles also and fragments of shell sometimes lay open and fracture the joint, and carry away, perhaps, a portion of the deltoid muscle. In

these or other injuries of the shoulder-joint, unaccompanied by damage to the large vessels and nerves, and when the bone is not too much splintered or comminuted in the shaft, the judgment of the surgeon must determine the propriety of an attempt to save the limb. Extensive fissures do not absolutely interdict excision, and while decapitation of the humerus is ordinarily alone required, four and even five inches of the bone have been removed without detriment to the result. Sometimes, on the other hand, only a portion of the articulating surface of the humerus seems to need removal; but the subsequent mobility of the arm will be less restricted if the whole head of the bone is taken away. Unfortunate results do not, however, as a rule, follow partial excision in this, as in other joints.

As gunshot wounds are of so variable a character, injuries to the coracoid and acromion processes, to the clavicle, and more rarely to the body and neck of the scapula, will occasionally be found complicating that of the humerus. Although extensive fracture of the scapula destroys the probability of success, fragments of it have been removed, and recovery has ensued, notwithstanding the profuse suppuration and protracted treatment following.

A patient with a shattered head of the humerus may recover without an operation, but, to say nothing of greater safety, more rapid and better results follow excision than the gradual exfoliation of fragments.

The time required, and the condition left by the slow processes which accompany the latter course, are more unlikely to give a useful arm. As the operation can be performed with the same, if not more success, after the establishment of suppuration, a certain amount of delay is admissible in doubtful cases. Statistics show that secondary excisions of this joint are more successful than primary, in the proportion of 17 to 10. This is explained by the fact that it is the less grave cases which are reserved for expectant treatment, and because, by the lapse of time, and after the establishment of suppuration, the exact extent of the injury can be determined in a manner not always easy at the time of its occurrence. In the one case all is excised which should be; in the other, the removal may fall short of its proper limits.

Operation.—Formal incisions will often be modified by wounds of the soft parts. When this is not the case, a straight incision, commencing as high as the acromion and just external to the coracoid process, the point of the knife penetrating to and keeping in contact with the bone, is prolonged downward along the anterior aspect of the joint. This corresponds with the bicipital groove containing the long head of the biceps muscle, which, released from its sheath, is to be held to one side and preserved undivided. The tendons of the scapular muscles, which in a great measure form the capsular ligament, are then put on the stretch by rotating the arm inward or outward,

according to the side on which they are to be attacked, and divided with sufficient freedom to allow the head of the bone to be tilted from its socket. The posterior circumflex artery, a vessel of large size, and the circumflex nerve, both of which pass close to, and just below, the head of the humerus, must be respected, if possible. Another method of performing this excision consists in making a crescent-shaped incision posteriorly, commencing beneath the acromion and proceeding backward and downward. As the patient lies on his back, it permits the secretions to escape with great facility, and the burrowing of matter is thereby prevented. The preservation of the long tendon of the biceps is more difficult in this method than in the preceding. The section of the bone is accomplished with the saw, the soft parts being protected by a spatula or card passed behind it. In cases of fracture of the neck, and when the head cannot be turned out of its place, it must be seized by strong forceps, (tooth forceps for instance,) and removed in the manner which circumstances will permit. In such instances it is only necessary to cut off the sharp edges and irregularities of the shaft of the bone.

After-treatment.—The tendency of the latissimus dorsi and teres major to draw the extremity of the humerus inward, is to be prevented by a pad or cushion in the axilla. Besides this, repose, with the shoulder and arm supported on a pillow, cold-water

dressing for the first few days, and subsequently gentle compression by bandages, to prevent the burrowing of pus down the arm, with a sling and the confinement of the humerus to the side of the body, constitute all the treatment which can be required until passive motion is to be attempted. This is generally admissible by the second or third week, and is to be practiced daily, unless contraindicated by the symptoms or the extreme pain produced. The surgeon may console himself for the slow progress of his case by remembering that the chances of anchylosis are said to be in proportion to the rapidity of cure.

ELBOW-JOINT.

The exposed position of the elbow, both in loading and firing, makes it, like the shoulder, constantly the recipient of gunshot injuries; and the choice between amputation and excision is far more difficult than in the last-named articulation, which from its anatomical position can, even under adverse circumstances, be kept tolerably immovable, and consequently free from many sources of after-trouble with much greater ease than the elbow. Either for this or some other reason, not apparent, gunshot wounds of the joint of the elbow less frequently do well without operation than those of the shoulder. When left to nature, the track of a ball which passes near the joint, as well as the joint itself, usually becomes carious, and ultimately demands excision.

"I have seen," says Macleod, "several cases in which, after being traversed by a ball, attempts have been made to save the elbow without excising it; but such trials were anything but encouraging. The motion of the joint and its consequent use will be found much greater after excision than when the arm has been saved without operation."

It would perhaps seem that nothing could be more easy than to diagnosticate the injury which the bones of a joint like the elbow may have received. Such is not the case, however. The whole upper end of the ulna may be crushed and fractured into the joint, yet leave no deformity, and allow the patient to perform all the usual movements. This is owing to one of the peculiarities of gunshot fractures, viz., the preservation of the periosteum unlacerated, whereby the fragments are bound together, and the form of the bone is retained. It follows, therefore, that in an examination of a gunshot fracture, either in this or any other joint, very little assistance can be derived from the common probe. The only reliable probe is the surgeon's forefinger, and to admit this the wound of the soft parts may at any time be enlarged.

In extensive injuries, the state of the soft parts, the condition of the large blood-vessels, and the probable extent of fissures must decide the question of operation. "As regards the results, it is of no consequence whether the excision is performed in the first forty-eight hours, or after the full development of suppuration."—*Stromeyer.* In no joint are the pro-

priety and advantages of excision so conclusively established as in this.

Operation.—The elbow is excised by a straight incision along the inner border of the olecranon, extending three inches above and three below that process. If the operation is performed after the parts have become stiffened by inflammation or serious infiltration, a second short incision at right angles to the first may be carried outward over the end of the olecranon toward the external condyle. The entire thickness of soft parts should be raised on either side from the surface of the bone, special care being taken that the ulnar nerve, where it lies in the groove at the inner side of the olecranon, is not interfered with. This can only be insured by keeping the knife constantly in contact with the bone. The soft parts in which it reposes, or the nerve itself, if it is released from its sheath and exposed, should be held to one side; division of the lateral ligaments and conjoined tendons will then freely open the interior of the joint. The advantage of the straight incision is, that the connection of the triceps tendon by its edges with the investing aponeurosis of the arm and forearm remaining intact, an attachment for the muscle is thus effected, which diminishes to a certain extent the loss of power following the unavoidable division of the tendon at its insertion into the olecranon. It is true that a transverse incision facilitates the operation, but it is far better to secure this temporary conve-

nience by extending the longitudinal incision, than to sacrifice the important permanent advantage which the single incision promises to secure.

The extent of the incision must be such that when the parts are brought together, the bones neither lock nor refuse easy flexion. The insertions of the biceps and brachialis anticus muscles are to be preserved whenever possible, and it is to be remembered that in dividing the ulna and radius low down, the interosseous artery will be endangered. Four inches of bone above and four below the joint have several times been removed, a useful arm being regained. In operations, however, which open the medullary cavity of the shaft, the dangers of myelitis are to be dreaded. Partial excision, on the other hand, even if the end of one or more of the bones appears uninjured, is not admissible, as such cases are more liable to fail, and are less satisfactory in the resulting mobility when they succeed, than if the whole articulation is removed. In many instances, the detachment of fragments, and smoothing off the sharp processes of the fractured bones with bone forceps, will constitute the whole operation of excision.

After-treatment.—For the first week, and until suppuration has become established, the arm should repose on a pillow bent at an obtuse angle of about one hundred and thirty degrees, (that being one of greater ease than a right angle,) with cold-water dressing to the wound. Subsequently poultices may

be substituted; but in all excisions it is to be remembered that the long-continued use of poultices retards adhesive processes and encourages suppuration and ulceration. It will not be before the expiration of the second or third week that a rectangular splint can be applied, and this, if possible, should be one which permits of a variation from day to day of the position in which the arm is to remain flexed. Passive motion is to be commenced at the earliest moment the wound and the patient's endurance will permit, and be faithfully kept up by the surgeon as frequently as it can possibly be practiced.

WRIST-JOINT.

Under the title of this excision are to be included all operations which excise a part or the whole of the ends of the radius and ulna, a part or the whole of the carpus, the proximal ends of the metacarpal bones, or even all of these together. It will at once be seen that in this operation the first law of excisions can rarely be fulfilled, viz., that, together with the partial or complete removal of the articular extremities of the bones, there shall be a free exposure or destruction of the synovial cavity of the joint.

Of all the principal excisions performed for disease, that of this joint is the one on which least reliance is placed. In default of experience, therefore, the inference is that in military surgery it will furnish still less favorable results. The "wrist" was excised three

times during the Crimean war, with one fatal result, and the end of the radius has been quite a number of times successfully removed in cases of compound dislocation. There is consequently precedent sufficient, perhaps, to authorize renewed trials in cases not accompanied by too great laceration of the soft parts.

Operation.—The removal of any part of the wrist-joint, for gunshot injury, can hardly be accomplished without division of the extensor tendons; indeed, the lesion prompting interference will probably have already effected this. The fractured bones must be patiently dissected out, and the detachment of fragments will in most cases constitute the whole operation. The end of the radius may, perhaps, admit of removal with the saw.

After-treatment.—This is to be conducted upon general principles; but after the first few days, the fingers and the thumb should be kept semi-flexed by resting upon some rounded body, (a roller bandage, for instance,) so that, if any motion is retained, their approximation may be more readily accomplished. Passive motion of the fingers cannot be attempted for considerable time after the operation, but should be begun as soon as possible. The restoration of but slight mobility is, however, to be expected.

HEAD OF THE FEMUR.

Even when the upper part of the femur has been shot through, rotation outward and crepitus are not

always present, and sometimes very considerable power of flexion and extension remains. The degree of injury and the condition of the parts after a bullet wound of the hip-joint are indicated by still more inconclusive symptoms, and are as difficult to determine as the cases are certain to terminate fatally.

"Picture to yourself," says Mr. Guthrie, "a man lying with a small hole, either before or behind, in the thigh,—with no bleeding, no pain, nothing but an inability to move the limb, or to stand upon it,—and think that he must inevitably die in a few weeks, worn out by the continued pain and suffering attendant on the repeated formation of matter burrowing in every direction, unless his thigh be amputated at the hip-joint, or he be relieved by the operation of excision, which, I insist upon it, ought first to be performed."

The cases permitting this operation are of infrequent occurrence, and are confined almost exclusively to bullet or shell wounds, involving the neck of the femur, or the trochanters, or which fracture the shaft in their vicinity.

But ten instances in which the head of the femur has been removed for traumatic cause have ever been published. Seven of these were performed in the Crimea, and of the entire number but one recovered.

The chances of recovery after disarticulation in military practice may be inferred from the statement that the operation was performed by the English fourteen times, and by the French thirteen times, in the Crimea, without a single recovery, and in the Schles-

wig-Holstein campaign seven times, with but one successful result.

Which of these alternatives, then, is to be adopted? By following an expectant course, and trusting to the resources of nature, an almost invariable mortality will ensue. It is equally rare for disarticulation to succeed, or for patients to survive more than a day or two after its performance. The remaining resource, excision, possesses at least the advantage of not putting life in immediate danger, one of the patients in the ten cases alluded to having survived five weeks, others from six to seventeen days, and only one so short a time as twenty-two hours; while, if the present percentage of recovery is maintained in a larger number of cases, it will prove a very much less fatal operation than disarticulation.

Excision of the head of the femur, therefore, merits further attention from the military surgeon, and offers an additional chance of saving life in an otherwise almost hopeless class of cases. This is the only aspect in which the question is to be regarded; the usefulness of the limb left is a consideration not necessary to be entertained.

Contrary to the course admissible in the upper extremity, in the hip, excision should be primary and immediate; suppuration and exhaustion, or more rapidly acting causes, being sure to lead to a fatal result if anything like an expectant plan of treatment is adopted and the operation is deferred. And it may

be said here, with regard to all excisions, that if the patient is in a state of shock, the administration of ether (of the inhalation of which, under these circumstances, there need be no fear) will often bring up the pulse and excite reaction to an extent authorizing an operation. The shock following excision, and due to it alone, is necessarily less than that of an amputation, since the blood contained in the limb is not lost. Death from this cause has, however, followed excision of the larger articulations, and the surgeon should be forewarned of the possibility of its occurrence.

Operation.—A curved incision just above the prominence of the great trochanter, with its convexity directed downward in the long axis of the limb, or a straight incision in a line with the shaft of the femur, five or six inches in length, the center of which shall correspond to the trochanter, exposes the upper part of the femur in a manner well suited for its removal, and without endangering any important vessels. Whenever the head still maintains its connection with the rest of the bone, the precaution should be taken to dislocate it from the acetabulum before detaching it from the shaft. The comminuted fragments are to be dissected out, or the upper portion of the bone protruded and sawed off. The great trochanter, whether injured or not, should always be removed, otherwise it will project into the wound, prevent healing, and act as an obstruction to the

discharge of pus or exfoliating fragments of bone. In the single successful case of excision for traumatic cause, five inches of bone were removed.

After-treatment.—Subsequent to the operation, little more is required than rest, and the maintenance of the limb in a proper position and right direction with the body. The tendency in the end of the femur to protrude at the wound is a point especially to be remembered. A bottle of water of variable weight, at the end of a cord attached to the leg by means of sticking plaster, and then passing over a pulley at the foot of the bed, will partially secure these ends, but no regular extension with splints or apparatus is admissible; shortening or deformity are of little importance if the patient's life is saved; and to secure this, his comfort and repose, free from bandages, or their frequent adjustment, are more important considerations than the precise position or condition of the limb. In the successful case already alluded to, the limb was placed in a sling of stout canvas, which hung from a beam over the man's cot, and the plane of which formed an angle of twenty degrees with the horizon. This method of treatment was adopted in order to approximate the upper end of the bone to the pelvis, as well as to prevent the lodgment of matter among the tissues and to favor its escape. At the end of three months the patient was able to leave his bed, upon crutches. The sling adopted in this case has since been imitated in many

instances of the operation for disease, and has been much liked by those who have used it.

KNEE-JOINT.

The gravest symptoms follow the penetration of the knee-joint by a gunshot missile. Macleod says:—

"I have never met with one instance of recovery in which the joint was distinctly opened and the bone forming it much injured, unless the limb was removed. * * * * * * * I have conversed with many persons, of large experience, on the subject, but never heard of any case recovering in which the diagnosis of fracture of the epiphysis was without a doubt." Esmarch declares that "all gunshot injuries of the knee-joint in which the epiphysis of the femur or tibia has been affected demand immediate amputation of the thigh."

Fractures of the patella, in which the joint is not otherwise implicated, are, however, an exception to this general rule, and authorize attempts at the preservation of the limb without operation.

Whether excision may be adopted with any propriety as a substitute for amputation in the class of injuries above referred to, statistics unfortunately do not enable us to decide.

Only six instances are known in which this joint has been excised for gunshot injury. One,—complete excision and a secondary operation,—performed in the Crimea, proved fatal after twenty-eight days, from exhaustion and diarrhœa. A second occurred in the Indian campaign of 1857–58, when a native

soldier underwent amputation of the left thigh and excision of the right knee, and died the next evening, with symptoms of shock. The third case, one of partial excision, the end of the femur alone being removed, was performed three days after the injury, during the Schleswig-Holstein campaign, and terminated fatally a month after the operation, from tubercular disease and pyæmia. A fourth case, of which no details are given, proved fatal from pyæmia within a few days of the operation. Of two other cases occurring in civil practice, the wounds being from shot-guns, one was fatal from tetanus, two days after the operation, and the other recovered at the expiration of three months. Of six other cases of excision for incised wounds, compound dislocation, separation of the epiphysis, etc., and occurring in civil practice, two only ended in recovery.

Such is the discouraging catalogue of attempts to save the limb by conservative means; of twelve operations, only three proved successful.

Results derived from so small a number of operations do not authorize a comparison with those of amputations, the mortality following which, when performed at the lower third of the thigh for traumatic cause, in military practice, is 56·6 per cent. (*Macleod.*)

It is impossible within the present limits to discuss the conditions which demand excision. The judgment of the surgeon must decide the question in the

presence of each individual case. It is only in slight wounds of the joint that the operation is to be undertaken; when the extent of injury to the bone is such that considerable portions of it must be removed, excision is not the appropriate operation. If decided upon, it should always be done immediately after the accident; for if suppuration and inflammation once establish themselves, the chances of success for either excision or amputation become very small indeed.

Operation.—The simplest and best method of excising the knee-joint is by a circular incision, extending half way round the limb, on a line with the articulating surface of the tibia. It freely exposes the joint, and the dependent situation of its two ends favors the discharge of matter. It also permits the division of the hamstring tendons without any additional puncture or incision, and this is a step always desirable to take in order to prevent the displacement of the leg, which so often happens during the first part of the treatment from the contraction of the muscles of the back of the thigh, especially of the biceps muscle inserted into the head of the fibula. The joint being opened, division of the crucial ligament permits the head of one bone, by flexing the limb, to be lifted up and opposed to the other in such a way that its section may be accomplished by the saw without endangering the vessels of the popliteal region. A thin segment of the articular surface of the bone remaining uninjured, (such being

the case,) is also to be removed, and on no account is the patella to be left. Its usefulness is forever destroyed by the operation, and its presence is liable to excite disease in the bones, and protract the treatment. The limit to which the excision may be carried is a narrow one, for, to say nothing of the extreme shortening, if it exceed the expanded enlargements of the extremities of the bone, there will be a too small basis of support at the point of anchylosis to insure safety and usefulness in the limb preserved.

After-treatment. — Absolute immobility during the after-treatment is all-important. Perhaps no means of attaining this end can be more effectual than the use of silver or iron wire sutures applied at the time of operation by means of a drill carried obliquely through the edges of both bones on each side of the limb; the ends being twisted, the bones are brought into firm and close contact. At the end of six weeks the wire may be cut and drawn out by main force. It is not known that this method of securing immobility has been attempted in traumatic cases, but its success in operations for disease suggests the propriety of its trial. The policy, however, which must govern the surgeon in the management of these cases should be one of extreme caution, free from meddlesomeness, and directed to saving the life of his patient rather than the usefulness of the limb. The application of a well-padded posterior splint is in

no case to be omitted; and in a camp hospital after the first few weeks, when swelling has subsided, and the immediate danger to life appears less imminent, the proper position and repose of the limb may sometimes be efficiently secured by a starch bandage, in which an aperture is left corresponding with the wound. An apparatus of some kind, which perhaps will often have to be extemporized by the surgeon, is, however, absolutely necessary until sufficient consolidation has taken place to admit of handling the limb without risk of disturbing the bones. During the second dressing, displacement of the tibia backward is liable to occur unnoticed by the surgeon, who may discover it only when it is too late to be remedied; a considerable length of time must therefore be allowed to elapse before this is performed, and the first dressing should be made with reference to such a course. Some of the external applications may be changed, and the remaining dressing kept from becoming offensive by the free use of a solution of chloride of soda. The limb should not be lifted from the bed for as long a period as possible. The swelling of the whole limb, which frequently accompanies the slow process of recovery, may be restrained, if not prevented, by careful and smooth bandaging from the foot upward.

ANKLE-JOINT.

The ends of the tibia and fibula have been removed only on one or two occasions for gunshot injuries, and then without success. The operation in these cases consisted rather in a removal of comminuted fragments of bone, than in a regular excision. Indeed, it is not easy to foresee circumstances likely to occur in the field, in which complete excision of the ankle-joint would be advisable. The recoveries which have followed the operation in cases of compound dislocation in civil practice indicate its propriety in accidents of that sort happening to soldiers, and which in the artillery and mounted service cannot be of infrequent occurrence.

The astragalus, in cases of its irreducible and compound dislocation, may be removed, when manipulation and the division of bands which seem to prevent will not allow of its reduction.

In cases where the ends of the tibia and fibula, or the entire astragalus, are removed, and the joint destroyed, even if life is saved, a useful limb cannot be promised with any degree of assurance. Anchylosis and considerable shortening are the best results to be hoped for.

In removing any of the parts about the ankle-joint, the posterior tibial artery will necessarily be divided. The preservation of the anterior tibal is therefore of great importance.

The application of adhesive straps in such a way as to keep the osseous surfaces approximated, and yet allow a free exit to all discharge, a carved side-splint, such as is sometimes used for fracture of the leg, and the resting of the limb on a pillow, are the chief features of the subsequent local treatment.

TARSUS.

The os calcis and part of the astragalus, and the os calcis alone, were successfully removed in the Crimea, the former once, and the latter four times. The os calcis, in cases of its comminution without implication of any other bones, must frequently permit of excision when amputation would otherwise be necessary. With this exception, gunshot wounds of the tarsus, though they sometimes authorize attempts at *preservative* surgery, rarely justify conservative steps.

SMALL JOINTS OF THE HAND AND FOOT.

Injuries of the metacarpo or metatarso-phalangeal and phalangeal joints of the fingers and toes seldom leave a choice between excision and amputation, except in cases of compound dislocation. This, in the toes, is infrequent, and hardly met with except at the metatarso-phalangeal joint of the great toe. Both here and in the thumb, excision is a more judicious treatment than simple reduction, and averts the grave

inflammation and suppuration which almost invariably follow the accident.

In excising the joints of the fingers, it must be borne in mind that the preservation of motion is most important in the metacarpo-phalangeal joints, or in those of the proximal phalanges; for if the proximal be stiff, no amount of motion in the distal joint can be of service; but if the proximal joint can be voluntarily flexed, a very small degree of mobility in the distal makes the finger a useful one. A stiff, straight finger is always in the way, and patients themselves will oftentimes ultimately solicit their amputation.

In the foot, the anchylosis and abbreviation, the scars and prominences which are left by excision, interfere with comfort when the shoe is worn; and although the foot requires a broad surface to sustain weight, and a certain length for easy walking, it can better bear the loss of a toe than pressure on an irregular and tender cicatrix.

Excisions of large joints are never to be practiced on the battle-field, or under conditions which will require the immediate transportation of the wounded. It is only in stationary hospitals, or under circumstances where the sick can be left behind, that they are to be attempted. Exceptions to this rule may sometimes be made for excisions of the upper extremity; but even in these, unless considerable time

has elapsed, removal can hardly fail to cause displacement of the parts, inflammation of the wound, and the consequent train of abscesses, constitutional disturbance, and, it may be, of graver accidents—pyæmia, myelitis, necrosis, etc. Patients with excised joints are, however, always to be transferred, at the earliest suitable opportunity, from regimental to general hospitals, where they can remain undisturbed till recovery has taken place.

After an excision a successful issue depends upon constant personal superintendence on the part of the surgeon, and a continued call upon his patience and ingenuity is made by the requirements of necessary apparatus, or the varying modifications which it demands, and upon his judgment, either in maintaining absolute rest, if anchylosis is desired, or in regard to the time when passive motion shall be commenced, the frequency with which it shall be applied, and the indefatigable perseverance with which it shall be followed up when active local symptoms have subsided.

Useful and serviceable results, as a rule, are hardly attainable in less than a year from the time of excision. Soldiers may occasionally return to a modified duty in a less period than this after removal of the head of the humerus or of the elbow-joint, but a slow convalescence is alone to be expected. The subjects of these operations are therefore to be considered as permanently invalided. In view of long hospital

confinement and protracted suppuration, it must be borne in mind, then, at the outset, that a patient may make a good recovery from a primary amputation when he will not survive a secondary amputation required by the failure of an ill-advised excision.

VENEREAL DISEASES.

VENEREAL DISEASES.

It is in the highest degree gratifying to be able to assert, upon the authority of the reports of the surgeons of the United States army now in the field, that in modern times there has never been collected so large a body of men among whom venereal diseases have prevailed to so small an extent. Since, however, this class of diseases is still a fruitful source of the disqualification of men for active service, the following attempt has been made, at the request of the Sanitary Commission, to embody, in as brief a space as possible, the teachings of modern science upon this subject, with special reference to the wants of army surgeons.

SECTION I.

PREVENTION OF VENEREAL DISEASES.

The following regulations, enforced in the Belgian army, have been found by experience to render venereal diseases "by far less frequent." So far as practicable, they are worthy of adoption in our own army.

1. Every soldier who contracts venereal disease, should be required to give the name and address of the woman who infected him; and if, upon examination, she be found diseased, her removal from the neighborhood should be enforced by the military authority.

2. Every inducement should be presented to lead men to report themselves at the earliest possible moment after infection; and delay should be visited with appropriate penalties.

3. No person with any venereal disease, however slight, should be allowed to remain in quarters, but be at once transferred to the hospital.

THREE FORMS OF VENEREAL DISEASE.

There are three separate and distinct venereal diseases, viz., Gonorrhœa; the simple Chancre, or Chancroid, with its attendant bubo; and Syphilis, including the initial lesion, or true chancre, and general symptoms. The first two are local, and the last a constitutional affection.

SECTION II.

GONORRHŒA, AND ITS COMPLICATIONS.

1. The idea that gonorrhœa is dependent upon the syphilitic virus, and requires the use of mercurials, is without foundation. "To compel an unfortunate patient to undergo a course of mercury for a disease

which does not require it, is a proceeding which reflects dishonor and disgrace upon the character of a surgeon."—*Sir Astley Cooper on the Use of Mercury in Gonorrhœa in Guy's Hospital.*

2. The treatment adapted for most cases of gonorrhœa consists of injections of a weak solution of some astringent, as from one to three grains of the sulphate or acetate of zinc to the ounce of water, repeated every four to six hours. Internally, a free purge at the outset, followed by laxatives if necessary to insure a daily evacuation from the bowels; alkaline mixtures, as solutions of the carbonates of soda or potassa, the acetate or chlorate of potassa, liquor potassæ, etc., and copaiva or cubebs.

3. When the symptoms are decidedly inflammatory, they should first be subdued by rest, cathartics, and low diet, before resorting to injections. Injections are also contraindicated in cases complicated with prostatitis or cystitis.

4. Copaiva and cubebs should be given in somewhat full doses from the outset of their administration, but, at the same time, care should be taken not to carry them to the degree of intolerance. Excessive action upon the bowels should be restrained by opiates or astringents, in order that their active principle may be eliminated by the kidneys and pass off in the urine. They should be suspended if they occasion uncontrollable nausea or diarrhœa, a cutaneous eruption, severe pain in the kidneys, or gen-

eral debility. Useful formulæ are the following: ℞. Copaviæ, Spt. ætheris nitrici, āā ʒj; Liquoris potassæ, ʒij; Spt. lavandulæ comp. ʒij; Syrupi acaciæ, ʒvj. M. (Lafayette mixture.) *A tablespoonful three times a day.* ℞. Pulveris cubebæ, ʒviiss; Pulveris aluminis, ʒss. M. *This quantity to be taken daily in three doses.* Copaiva solidified by magnesia, (16 parts to 1 by weight,) and made into boluses, is a convenient mode of administration.

5. Medication, both external and internal, should be continued for ten days after all discharge has ceased.

6. The "abortive treatment" of gonorrhœa is adapted only to the commencement of the disease, before acute symptoms have set in. The best formula for its administration is a weak solution of nitrate of silver, (gr. j ad aquæ ʒij,) injected every two hours until the discharge becomes thin and watery, (which usually takes place within twenty-four hours,) and then omitted. Copaiva may be given simultaneously.

7. Chordee may be prevented by drachm-doses of the tincture of camphor in water, taken at bedtime.

8. Commencing abscesses along the course of the urethra should be opened as soon as detected, even before fluctuation can be felt.

9. Acute prostatitis may be recognized by frequent and painful micturition, a throbbing pain in the perineum, and more or less general febrile excitement;

and the finger introduced *per anum* detects the enlarged and sensitive gland encroaching upon the rectum. Retention of urine frequently ensues, and requires the introduction of a catheter. When the instrument reaches the prostatic portion of the urethra, it excites great pain, and meets with an obstruction, due to the swollen gland, which is readily overcome by gentle and continued pressure, the handle of the catheter at the same time being depressed. This affection may terminate in resolution or in suppuration. The latter is announced by repeated chills; and, if the abscess points toward the rectum, fluctuation may be detected by the finger introduced *per anum;* more frequently, however, the matter tends to escape by the urethra.

10. Acute prostatitis is to be treated at its commencement by absolute rest, cups followed by poultices to the perineum, warm baths, and laxatives or enemata. The bladder should be evacuated, when necessary, with the catheter. If suppuration ensues, the abscess should be opened at an early period in whichever direction it tends to point, either with a knife through the rectum, or with the point of a catheter through the urethra.

11. Gonorrhœal cystitis is commonly limited to the neck of the bladder. Its symptoms are an urgent and frequent desire to empty the bladder; sharp pain attending the flow of the last drops of urine; the admixture of pus or blood with this fluid; tenderness of

the hypogastric region; pain radiating to the groins, perineum, anus, and along the course of the urethra. There is usually less febrile excitement than in acute prostatitis.

12. Gonorrhœal cystitis is to be treated by rest, warm baths, cups, and poultices to the hypogastrium, and internally by saline laxatives, the carbonates of soda and potassa, the acetate or chlorate of potassa, liquor potassæ, mucilage, flaxseed tea, and copaiva.

13. Gonorrhœal epididymitis (swelled testicle) is best treated by the horizontal posture; support of the scrotal organs; an emetico-cathartic, as a solution of Epsom salts and tartarized antimony, given in sufficient doses to act freely upon the bowels and maintain slight nausea; the application of leeches or cups just below the external abdominal ring, or bleeding from the scrotal veins—(the patient in a standing posture, and the scrotum compressed at its neck, either with the hand or a fillet, and bathed with hot water until its veins are well distended;) and hot poultices, either of flaxseed or tobacco leaves, to the affected part. Evacuate any collection of fluid in the tunica vaginalis; and, even in the absence of any marked degree of hydrocele, Velpeau's treatment by means of multiple punctures with a lancet is worthy of a trial. When the acute symptoms have subsided, employ a more tonic regimen, and strap the affected testicle. Mild urethral injections are not contraindicated by the occurrence of swelled testicle.

14. Gonorrhœal ophthalmia requires the strictest attention to cleanliness, the frequent use of an astringent collyrium, freedom of the bowels, and, in most cases, tonics or stimulants. The eyes should be bathed every fifteen minutes with a solution of a drachm of alum to a pint of tepid water, or a decoction of poppy heads. The surgeon, at his daily visit, after thoroughly cleansing the mucous membrane of its purulent secretion and the adherent masses of coagulum, should snip the chemosed portions of the ocular conjunctiva with scissors, and, after the bleeding has ceased, pencil the whole affected surface either with the solid crayon of nitrate of silver, or with a strong solution of the same salt, (ʒj–ʒj ad aquæ ℥j,) washing off the residue with tepid water as soon as the surface has become whitened. In addition, a solution of five grains of nitrate of silver to the ounce of water may be dropped in the eye three or four times a day by the attendant. An active purge at the outset of treatment is desirable, and a daily evacuation of the bowels should be secured.

The great danger to vision is from ulceration and slough of the cornea, a tissue of low vitality, and a disastrous termination of the disease is favored by a low condition of the general system; hence all depressing agents, as venesection, mercurials, tartarized antimony, abstinence from food, etc., are to be avoided, and a nourishing diet, porter, ale, quinine, and other tonics, to be enjoined. If ulceration of the cornea

occurs, its progress may perhaps be arrested by lightly touching the surface with a pointed crayon of nitrate of silver; and the pupil should be kept constantly dilated with atropine or belladonna. Poultices of every kind are to be strictly prohibited, and the eye left uncovered. The discharge is highly contagious, and the utmost caution should be used to prevent its coming in contact with a sound eye.

SECTION III.

THE SIMPLE CHANCRE AND ITS ATTENDANT BUBO.

1. The simple chancre, for many years confounded with true syphilis, is now known to be an entirely distinct affection, local in its character, and not requiring the use of mercury in its treatment. We are indebted for the demonstration of this fact to Bassereau, who, by an extensive comparison of individuals bearing venereal ulcers with the persons who infected them, has shown that when the disease remains local in the former, it was likewise so in the latter; and, on the other hand, that if it affects the general system in the one, it has done the same in the other; and this result has been confirmed by Ricord, Fournier, Clerc, Caby, Dron, Rollet, and Diday, of France; by Mr. Henry Thompson, Mr. Henry Lee, and Victor de Meric, of London, and numerous other observers. Independently of clinical experience, therefore, the distinct nature of the

simple chancre and of true syphilis rests upon the same proof that is relied upon by naturalists in the determination of species in the animal and vegetable kingdoms, viz., upon the immutability of their characteristic features in successive generations. But, above all, the recognition of this truth is sustained by clinical experience, which shows that a wide disparity exists between one class of cases in which, even without the administration of mercury, the disease disappears forever with the healing of the ulcer; and another class, in which, without mercurials, general symptoms are sure to make their appearance, and, under the best-directed treatment, relapses may occur at any period of the remaining life of the individual. Moreover, the explanation formerly given of this disparity, that it was due to a difference of idiosyncrasies, is found not to bear the test of examination; and we are forced to the conclusion that the term syphilis, as used until a very recent date, embraces two distinct affections. To the one which is local in its character, the name of simple, soft, or non-infecting chancre, or chancroid, is now given; the term syphilis being retained exclusively for the constitutional disease.

2. The diagnostic characters of the simple chancre and the infecting chancre (the initial lesion of true syphilis) are the following:—

SIMPLE CHANCRE.

Origin.—Always derived from a simple chancre, or virulent bubo. Its first appearance generally within a week after contagion.

Anatomical Characters. — Generally multiple, either from the first or by successive inoculation.

An excavated ulcer, perforating the whole thickness of the skin or mucous membrane.

Edges abrupt and well-defined, as if cut with a punch, not adhering closely to subjacent tissues.

Surface flat but uneven, "worm eaten," wholly covered with grayish secretion.

No induration of base, unless caused by caustic or other irritant, or by simple inflammation; in which case the engorgement is not circumscribed, shades off into surrounding tissues, and is of temporary duration.

Pathological Tendencies. — Secretion copious and purulent, inoculable.

Slow in healing. Often spreads and takes on phagedenic action.

INFECTING CHANCRE.

Origin.—Always derived from an infecting chancre or secondary lesion. Its first appearance often from one to five weeks after contagion.

Anatomical Characters. — Generally single; multiple, if at all, from the first; rarely, if ever, by successive inoculation.

Frequently a superficial erosion: not involving the whole thickness of the skin or mucous membrane, of a red color, and nearly on a level with the surrounding surface. Sometimes an ulcer, when its

Edges are sloping, hard, often elevated, and adhere closely to subjacent tissues.

Surface hollowed or scooped out, smooth, sometimes grayish at center.

Induration firm, cartilaginous, circumscribed, movable upon tissues beneath. Sometimes resembles a layer of parchment lining the sore. Generally persistent for a long period.

Pathological Tendencies. — Secretion scanty, chiefly serous; inoculable with great difficulty, if at all, upon the patient or upon any person under the syphilitic diathesis.

Less indolent than the chancroid. Phagedena rarely supervenes, and is generally limited.

May affect the same person an indefinite number of times.	One attack affords complete or partial protection against a second.
Characteristic Gland Affection.—Ganglionic reaction absent in a large proportion of cases. When present, one gland accutely inflamed, and generally suppurates. Pus often inoculable, producing a soft chancre.	*Characteristic Gland Affection.*—All the superficial inguinal ganglia on one or both sides enlarged and indurated; distinct from each other, freely movable; painless, and rarely suppurate. Pus never inoculable.
Prognosis.—Always a local affection, and cannot infect the system. "Specific" treatment by mercury and iodine always useless, and, in most cases, injurious.	*Prognosis.*—A constitutional affection. Secondary symptoms, unless prevented or retarded by treatment, declare themselves in about six weeks from the appearance of the sore, and very rarely delay longer than three months.*

3. When in doubt as to the nature of the venereal ulcer, treat it as a soft chancre, and keep the patient under observation until the period of incubation of general symptoms has passed. This rule is justified by the following considerations:—

a. Statistics show that there are four simple to one infecting chancre; hence, in a given case, the probabilities are in favor of the sore being of the former species.

b. Even if the sore should chance to be an infecting chancre, the administration of mercury will not prevent contamination of the general system, which

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* The Pathology and Treatment of Venereal Diseases; including the results of recent investigations upon the subject. By F. J. Bumstead, M.D., 1861, p. 394.

has already taken place. Moreover, nothing is lost by delay, since syphilis is equally amenable to treatment after the appearance of secondary as after primary symptoms.

c. We are not justified in subjecting a patient to a mercurial course unless the necessity of it is apparent.

d. An immediate resort to mercurials leaves the case in doubt, since there are no means of determining whether the subsequent immunity is due to the treatment or to the nature of the sore; and as it is not a matter of indifference whether a man has or has not in his system the germ of constitutional syphilis, no measures should be adopted which will leave the question undecided.

4. Cicatrization of a soft chancre may take place spontaneously, and is not hastened by the use of mercury. The most effective treatment consists in the destruction of the local sore by means of a powerful caustic; and the earlier this is applied the better the chances of success. For this reason, and also for the purpose of preventing the communication of the disease to others, venereal ulcers should be destroyed at the earliest possible period, even before their nature has been determined.

5. For the destruction of simple chancres, nitrate of silver, as commonly employed, is unreliable, and, in most cases, inadequate. Fuming nitric acid is the most convenient agent, and, if the fall of the eschar fails to leave a healthy surface, the application should be repeated.

6. Cleanliness is of the first importance, and that dressing is commonly the best which accomplishes this in the most perfect manner. Any collection of the secretion upon the surface of the sore, or upon neighboring parts, and the formation of scabs, should be avoided. Lotions are preferable to ointments, and may consist of simple water, a solution of tannic acid, (gr. iij ad aquæ ℥j,) a drachm of Labarraque's solution of chlorinated soda to two ounces of water; or a drachm of dilute nitric acid to eight ounces of water; and the dressing should be kept moist by being covered with oiled silk. Chancres beneath the prepuce will heal much more speedily if the glans be uncovered and the sore dressed with wet lint covered with oiled silk, and a circular bandage around the penis.

7. Phagedenic ulceration is far more likely to attack a simple than an infecting chancre, and is favored by a low state of the general system, however induced, and by a scrofulous diathesis. It is to be treated by placing the patient in the most favorable hygienic condition, by a nourishing diet, tonics, as the various preparations of iron in large doses, opium, and the free cauterization of the ulcer with nitric acid, Vienna paste, or the actual cautery. A solution of the potassio-tartrate of iron (℥ij ad aquæ ℥ij) is a valuable local application. The internal use of mercury is highly injurious.

8. A simple chancre may or may not react upon the neighboring lymphatic glands. In the former

case it gives rise to an inflammatory bubo, which may be either simple (containing simple pus) or virulent, (containing pus capable of inoculation.) The two varieties cannot readily be distinguished except by artificial inoculation, nor is their diagnosis of much practical importance. The former may sometimes be aborted by rest, the application of tincture of iodine, or a strong solution of nitrate of silver, (℥iij ad aquæ ℥j;) or by pressure, by means of compressed sponge and a spica bandage. The latter always terminates in suppuration.

9. As soon as fluctuation can be detected, the abscess should be opened, either by several small punctures, followed by an injection of the cavity with a solution of sulphate of zinc (gr. iij ad aquæ ℥j) or one part of tincture of iodine to four of water, and pressure, by means of a compress and spica bandage, be employed to insure adhesion of the walls; or the abscess should be freely opened by a *vertical* incision, (not parallel to the inguinal fold,) and the cavity, stuffed with lint, be left to heal by granulation.

10. Suppuration in a bubo affords a probability, although not an absolute certainty, that the accompanying chancre is of the simple, non-infecting species; since it is a general but not invariable rule that syphilis does not follow an open bubo.

SECTION IV.

SYPHILIS.

1. The term "syphilis" is used here to the exclusion of the local affection just referred to. The symptoms of this disease are commonly divided into primary, (including the initiatory chancre and accompanying induration of the glands,) and general, (including the so-called secondary and tertiary manifestations.)

2. A true chancre is the initiatory lesion of acquired syphilis, appearing at the point where the virus entered the system, and separated from the general manifestations of the disease by a period of incubation pertaining to the latter. Analogy would show that a chancre, like the vaccine vesicle, is already the result of absorption of the virus and of infection of the constitution, and not a mere local disease; hence, that its abortive treatment by destructive cauterization is incapable of averting general syphilis; hence, also, that it should receive the same general treatment as the latter manifestations of the diathesis. Clinical experience confirms this view, since thorough destruction of a chancre six hours after its first appearance has failed to avert general symptoms. The period of incubation possessed by the true chancre, and the fact that it is

not inoculable upon the patient, point to the same conclusion.

Experience also proves that the cicatrization of chancre, unlike that of a chancroid, is hastened by the internal use of mercury. This sore, therefore, demands the same internal treatment as general syphilis.

3. The same form of local dressing may be used for the true chancre as for the chancroid.

4. Induration of the neighboring lymphatic glands (indurated bubo) is one of the most valuable indications of an infecting chancre, and is always present, except, perhaps, in very rare instances. This bubo is commonly free from inflammatory action, and hence may pass unnoticed by the patient. It demands no special treatment, except in those unusual cases in which inflammation and suppuration take place, when the same treatment should be adopted as that already recommended for inflammatory buboes. The persistency of the induration for a long time after the primary sore has healed, is of great value in indicating the seat of the sore and in unraveling the history of obscure cases.

5. There is always an interval between the appearance of the chancre and of the general manifestations of syphilis. This period of incubation of general symptoms, so called, is fixed within certain bounds, like the incubation of other infectious diseases. Its average duration is six weeks; it rarely exceeds three,

and never six months; its shortest duration is about three weeks. A venereal ulcer will, therefore, be followed by general symptoms, if at all, probably within three, and certainly within six months. It is to be understood that this rule applies only to cases in which the natural course of the disease has not been interfered with by specific treatment. The administration of mercury for the primary sore may retard or altogether prevent the appearance of general symptoms.

6. Early general symptoms, especially in the absence of treatment of the preceding chancre, are very uniform in their character, and commonly consist of an eruption of blotches or papulæ upon the skin, pustules upon the scalp, swelling of the glands of the nucha, opaline patches (mucous patches) upon the mucous membrane of the mouth and fauces, condylomata about the anus, and alopecia, attended often by general malaise, headache, and fleeting pains in various parts of the body, (more particularly in the neighborhood of the joints,) which are most severe at night. These symptoms are especially worthy of remembrance, since they are often of so slight a character as not to fix the attention of the patient himself, and they should be carefully watched for after the occurrence of any venereal ulcer, the diagnosis of which was uncertain.

7. The secretion of secondary symptoms cannot, as a general rule, be inoculated upon the patient or upon

any person under the syphilitic diathesis, but is contagious to individuals free from such taint. This rule is equally true of the secretion of the primary sore or chancre, and is the same that obtains in other infectious diseases, as small-pox, vaccinia, etc. Syphilis contracted from a secondary lesion pursues the same course as when contracted from a primary lesion, commencing in both cases with a chancre.

8. The remedies required for the treatment of syphilis are, for the most part, included under the head of mercurials, the compounds of iodine, and tonics.

9. Mercurials exercise their greatest power over the primary sore and over early or so-called secondary symptoms. The action of the iodides is limited almost exclusively to the late or tertiary lesions. It is a mistake, however, to suppose that the compounds of iodine are alone sufficient for the permanent cure of even tertiary lesions, which are very prone to relapse, unless mercury has also entered into the treatment. The iodides are, therefore, to be regarded as temporary substitutes for, or as the adjuvants of, mercurials in the treatment of syphilis. They are of special value in syphilitic affections of the bones and periosteum; also in broken-down constitutions, when mercurials are inadmissible until a better condition of the system has been secured.

10. The value of tonics in the treatment of syphilis cannot be overrated. Chemical analysis of the blood of syphilitic subjects shows an excess of albu-

men and a diminution of corpuscles; in short, a condition of chloro-anæmia obtains. The teachings of clinical experience are still more decisive. Nothing so obstructs the successful treatment of syphilis, and nothing so conduces to a relapse after an apparent cure, as a low condition of the general system. Hence the surgeon should aim to build up, and not to pull down; and this is to be accomplished by placing the patient under the most favorable hygienic influences, and by the use of tonics, as iron and quinine.

11. No one form of mercurial is adapted to all cases. The following formulæ are given as examples of those most frequently applicable:—

℞. Pil. Hydrargyri, ʒj. Ferri Sulph. Exsiccat. ʒss. Divide into 30 pills. One three times a day.

℞. Hydrarg. Bichloridi, gr. ij. Tinct. Gentian. Comp. ʒiv. M. A teaspoonful.

℞. Hydrarg. Protiodidi, gr. x. In 20 pills. One after each meal.

℞. Hydrarg. cum cretâ, ʒj. Quiniæ Sulphatis, ʒss. M. In 30 pills. One three times a day.

℞. Hydrarg. Bichloridi, gr. ij. Potass. Iodidi, ʒij. Tr. Gentian. Co. ℥ij. Aquæ, ʒij. M. A teaspoonful.

℞. Hydrarg. Bichloridi, Ammoniæ Muriatis, āā gr. ij; dissolve in a sufficient quantity of water and add powdered cracker q. s. Syrupi Acaciæ, q. s. M. In 36 pills.

12. The action of mercury upon the bowels should, if necessary, be restrained by the addition of opium or astringents; and, in some instances, the internal use of the remedy must be suspended and inunction employed.

13. Salivation is to be regarded as prejudicial to the success of treatment, and should be carefully avoided; although it is often justifiable and even desirable to excite slight tenderness of the gums, in order to be sure that the full effect of the remedy has been obtained. Salivation is most successfully treated by omitting the mercurial, securing freedom of the bowels, astringent gargles, and the internal administration of the chlorate of potassa, (ʒj–ij per diem in solution.)

14. Mercurial cachexia is rarely induced when the remedy is judiciously employed, especially if combined with hygienic treatment and the use of tonics. If, however, in any case, after improvement continued for a time, the appetite begins to flag, and the patient complains of malaise and mental depression, the administration of mercurials should be suspended, and afterward resumed, if necessary to complete the cure.

15. The mode of using mercury which is the least likely to produce any of the above unpleasant symptoms is by inunction; and in very many cases this method will be found superior to all others. Its advantages are that it rarely salivates; that it leaves the intestinal canal undisturbed, and does not impair the appetite; and hence that it may be used in cases of general debility and of extreme susceptibility to the morbid action of the mineral, when it is of the first importance to sustain the vital powers by a nourishing diet and the administration of tonics, without

interference. About a drachm of the ointment should be rubbed into the axillæ and upon the inner surfaces of the thighs alternately every night, and the residue removed with warm water and soap the following morning.

16. The treatment of syphilis should invariably be conducted in a hospital. The dangers to be apprehended from exposure and hardship, while pursuing a mercurial course, are too great to admit of this treatment being undertaken in camp.

17. Little need be said with regard to the use of iodide of potassium, except that this salt should enter largely into the treatment of the latter forms of syphilis, as syphilitic tubercles, gummy tumors, deep ulcerations of the fauces and larynx, and the affections of the bones and periosteum; but although, in some cases, it may constitute the only remedy specially directed against the diathesis, which is admissible for a time, yet in all, mercurials should be sooner or later employed.

18. Treatment should be continued until all syphilitic symptoms have disappeared, graduating its severity according to the effect produced and the general condition of the patient; and even after the last manifestation of the diathesis has passed away, experience teaches that treatment must be still further prolonged if the patient would secure immunity for the future.

19. The limits of this essay do not permit of refer-

ence to the special treatment adapted to the various syphilitic lesions. It is desirable, however, to call attention to the importance, in syphilitic iritis, of keeping the pupil constantly dilated by means of a solution of belladonna, (one scruple of the extract to an ounce of water, strained,) dropped into the eye every few hours. Moreover, in the treatment of this affection, a combination of tonics with mild mercurials (as, for instance, quinine with the gray powder) will yield far more satisfactory results than the latter alone.

THE END.